THE

ELECTRICAL REVIEW.

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	Page
War, and the Neutrality of Science	449
Cables and Codes	450
Co-operation in Trade Expansion	451
German Agencies	451
Copper	451
Large Induction Motors: Some Features of Mechanical Design, by G. Moores (*illus.*) (*continued*)	452
Correspondence—	
German Culture	453
German Electrical Success: A Suggested Inquiry ...	454
Arbitrary Action of Public Authority	454
Capturing German Trade	454
Is "Earthing" an Extra?	454
New Electrical Devices, Fittings and Plant (*illus.*)	454
Reviews	455
Mechanical Charging of Blast Furnaces, by N. Kapp (*illus.*)	458
Coal-Cutting Machinery and the Output of Coal	460
War Items	464
The Osram Lamp Works (*illus.*)	463
The Crypto Electrical Co.'s Works (*illus.*)	465
Business Notes	467
Notes	472
City Notes	473
Stocks and Shares	474
Market Quotations	474
Problems of Industry, by "A Would-be Reformer"	475
Trade Statistics of Japan, 1913	477
Electrolytic Iron, by L. Guillet (*illus.*)	478
Utilisation of Heat Contained in Slag, by W. L. Johnson (*illus.*)	479
New Patents Applied For, 1914	480
Abstracts of Published Specifications	480
Contractors' Column ... ... Advertisement page	xviii

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WAR, AND THE NEUTRALITY OF SCIENCE.

SCIENCE is the common possession of humanity: it knows no distinctions of nationality or creed, it deals with fundamental verities, laws and relationships, its kingdom is not of this world only, it stretches to the confines of space and links us with the Universe.

The triumphs of Science are man's victories over Nature, her battles are for the advancement of mankind, her spirit is one of peaceful striving for the commonweal, and her ultimate aim is the conquest of Matter by Mind.

It is distressing at this time of international conflict to find that the neutrality of Science is in danger of being violated, and that a movement is on foot amongst men of science in Germany to divest themselves of distinctions bestowed upon them by British Universities and learned societies in recognition of the work they have done for mankind.

We expect from those who have climbed the steep paths and rugged ascents of the mountains of Truth, who have breathed the pure rare air of the heights, whose eyes have ranged the peaks of the Unknown, that they will bring with them some trace of the sublime calm of their surroundings, some gleam of the wide vision they have enjoyed, some sense of comradeship with those who have shared their labours and aided their efforts.

Let us see how far these expectations have been realised by some of our German colleagues: Dr. Lenard, Professor of Physics at Heidelberg, is credited in the *Hamburger Fremdenblatt* with the following expression of his views:—"Down, then, with all considerations for England's so-called culture. The central nest and supreme academy for all hypocrisy in the world, which is on the Thames, must be destroyed if the work is to be done thoroughly. No respect for the tombstones of Shakespeare, Newton and Faraday! We must realise that there can be no real peace with a highwayman until he has collapsed or has been destroyed."

This is by no means an isolated instance of the views held by men of science in Germany; indeed, it may be said to be representative of the opinions held by a considerable section of the German Intellectuals.

Comment is needless; the English attitude is well illustrated by the proceedings at the University of Melbourne on August 14th, on the occasion of the recent visit of the British Association, when on the conferment of honorary degrees the ovation of the afternoon was reserved for Prof. Johannes Walther, the distinguished German geologist. A perfect storm of applause greeted him as he came forward to take his degree, and it was renewed when Prof. Masson referred to him as a "worthy son of the great nation which has done so much to add to the sum of human knowledge."

In connection with the attitude of the German Intellectuals, it may not be without interest to ask ourselves how it comes about that such views can be held by men who may

claim justly to be recognised as leaders in Science, Philosophy, Literature, or Art.

It is probable that no single explanation can be applied to all cases, but that many factors contribute to what is certainly a curious psychological phenomenon. War is due to an impulse of primitive character, and we must recognise that abhorrence of everything connected with the foe is a primitive impulse which even the kaleidoscopic changes in the combinations of the Powers of Europe during the past centuries have not dulled.

In some directions we feel this impulse ourselves, and are, therefore, in a position to understand it in others so far as it applies to material things, but when it invades the realm of the spirit, and is applied to science, literature and art, we can only regard it as being barbaric.

To this primitive childlike impulse of comprehensive antagonism some of the animosity displayed by the German Intellectuals must be attributed; there are, however, other factors which contribute to this result, which in the main are peculiar to German culture. Of these factors we propose to consider briefly the influence of the following:—(1) German educational methods; (2) the military system; (3) ignorance of the English character; (4) materialistic philosophy.

Throughout the curriculum of the German schools the importance of discipline and obedience to authority is strongly insisted upon, and these principles, together with Prussian military ideals and methods, are inculcated also in the compulsory military training to which the young manhood of the nation is subjected, and are further impressed upon the civil life of the community by numberless official rules and regulations.

The adult whose working life has been steadfastly devoted to some specialised branch of intellectual activity frequently turns in a time of sudden crisis to the ready-made political ideas which he received in his youth. With politics, as with religion, it is the early training that tells, and one often finds men who appear to reserve for these subjects a particular corner of their minds which is strictly partitioned off from the remainder of their mentality, and does not share in its development.

The Prussian military caste have succeeded in impressing their views upon the whole nation, and the people have accepted them with something of the docility and obedience with which they receive a word of command. Add to this a system of Government which is in no real sense a representative one, an autocratic ruler who believes as implicitly as did Charles Stewart in the divinity of his kingship, and a Press which is subservient to the governing classes, and we can hardly wonder at the ignorance of the aims and character of the English people which is to-day displayed in all quarters of the German Empire.

Lecky, in his "Rise and Influence of Rationalism in Europe," has pointed out that in a period in which all the virtues of an uncompromising partisan are cordially recognised, the higher virtue which binds men through a love of conscientious inquiry to endeavour to pursue an eclectic course when party and sectarian passions rage fiercely all round them, is not only entirely unappreciated but is almost impossible.

A period of this character has existed in Germany for the past decade, it has been nourished on the one hand by the "heaven-born" crusade of the Kaiser for the Teutonising of Europe, and on the other by the bestial gospel of brute force preached by Treitschke, Nietzsche and Bernhardi.

Whatever action our German colleagues may take in withdrawing from our ranks in the army of science, and whatever the material results of the war may be, let us not lose sight of the essentially spiritual character of the work of the man of science and of the engineer.

Materialism has lit the fires of Rheims and Louvain: let us recognise with Emerson that Nature is not fixed but fluid, that spirit alters, moulds, makes it. A corresponding alteration in things will attend this influx of the spirit; it shall draw beautiful faces, warm hearts, wise discourse and heroic acts about its way until evil shall be no more seen.

Cables and Codes.

A MONTH ago we drew attention in these columns to the burden imposed upon British industry by the prohibition of cable telegrams in code. Various propositions were put forward at the time by firms with a view to securing the advantages of telegraphing in code whilst safeguarding the interests of the nation against the abuse of that privilege by our enemies, and alternatively we urged that a reduced rate should be charged for messages in plain language. The latter course has been adopted to a moderate extent by the Eastern cable companies in negotiation with the Government, as stated in our last issue, but the concession granted, which took the form of counting 10 letters as one word, cannot be regarded as of material value, especially as the use of telegraphic addresses is still prohibited. It is no wonder, therefore, that a great and growing agitation has sprung up in favour of further relaxation of the regulations.

The importance of free communication at cheap rates between this country and the Dominions, at least, was never greater than at present, when efforts are being made to secure the diversion of one-time German trade to our own factories, and the same applies with hardly less force to our communications with neutral nations in all parts of the world. Let it be granted that the risk of espionage is too great to admit of the use of codes in European countries, there still remains an enormous field in which trade can be cultivated by telegram, provided that the cost is not prohibitive.

We cannot help feeling that the abolition of codes is an ineffective precaution, out of all proportion to the enormous expense imposed by it upon British industry; the use of plain language is no bar to the ingenuity of an enemy who desires to convey valuable information to a confederate abroad, and indeed it is not improbable that the enemy's secret service provided for its use beforehand, as a "blind," for an open message naturally would excite less suspicion than one in cipher. We agree that if the employment of codes involves danger to this country, we must accept the situation no matter what the cost; but we doubt whether the desired object is attained by the authorities, and as a notorious example we may cite the telegram in "plain language" (!) by which a correspondent in South Africa announced the conclusion of peace terms to a London newspaper in 1902, under the nose of the censor. It is at present possible to transmit information by letter or by hand to neutral countries on the Continent, in the course of a day or two, whence it can be telegraphed to enemy countries; there appears to be little inducement, therefore, for a spy to telegraph by roundabout routes *viâ* Australia or India, at heavy cost.

If, however, the use of codes is absolutely not permissible under any conditions, at least the rates for plain language should be reduced to the utmost possible extent, even if the Government has to subsidise the cable companies, and we see no valid objection to the use of telegraphic addresses. Unfortunately traders are wholly at the mercy of the companies, whose attitude can hardly be called patriotic. Provided that their cables are fully employed, and that their revenue is maintained at the normal value, in justice they can ask no more. They must not forget that the British nation pays for the protection of their cables from foreign attack. Under present circumstances it is probable that the traffic has greatly fallen off and the cables are comparatively idle—the patriotic course, then, is to lower the rates to such an extent that the cables are again fully occupied and the revenue no less than it was before the war.

Co-operation in Trade Expansion.

We have received communications from several electrical manufacturers who desire to take action co-operatively in some of the markets mentioned in last week's leader on this subject. We invite other firms to intimate their interest in the matter to us privately, so that they may be brought into touch with others similarly disposed. Nobody will be committed to anything by taking this step, our idea being purely to encourage likely parties to confer in a preliminary way. The willingness on the part of several firms to consider the matter in conference should induce others to take advantage of that frame of mind while it exists. In our view, it is not too early for businesslike deliberations to take place, so that suitable preparations may be made in good time. Indeed, information has reached our ears of magnificent engineering contracts that have been lately booked in a market which our firms have long desired to enter, the contracts referred to having been secured because of a policy of concerted action arranged some time ago by a number of firms. This success alone, coming during war-time, suggests that there need be no delay in taking definite measures. Furthermore, news is coming in from different directions showing that buyers in other countries are wondering why it is that when Germany cannot supply them British travellers are not already on the spot to take their orders. They taunt us with the remark that if placed in a similarly favourable position Germany would have flooded their countries with travellers. Of course they cannot be expected to appreciate the difficulties in which we are placed at home at the moment, but the criticism is worthy of notice and ought to stimulate our firms to conference even if they cannot immediately act.

German Agencies.

British manufacturers in various lines have been receiving numerous inquiries from the agents of German firms, who, being cut off from their regular sources of supply, are naturally anxious to obtain substitutes for their specialities which will enable them to fill the orders that they have in hand. With regard to these inquiries, a word of caution may not be out of place. We all hope to see the German imports permanently replaced by British goods as far as possible when the war is over and things have settled down again. In the meantime there is no reason why orders should be declined because they come from such quarters—subject to one proviso. The agents not unreasonably wish to fill their orders with goods resembling their standard lines as closely as possible, in order to maintain continuity in this respect and thus to facilitate the resumption of importation when circumstances permit, but we suggest that if this desire is acceded to, a great part of the benefit to British trade that may be derived from the war will be thrown away. To our mind it is important that British manufacturers should preserve the distinctive appearance of their products on all occasions, and should take care to incorporate their names and trade marks in the substance of the goods in such a way, by moulding them on castings, inscribing them on dials and charts, &c., that it will be exceedingly difficult to remove or to conceal the evidence of British origin. In this way the ultimate purchaser will be made familiar with the appearance of British goods, while he appreciates their quality and learns the makers' names, so that his future orders will be accompanied by the stipulation that they shall be filled from the same sources. If manufacturers do not seize the opportunity and insist on supplying typically British products in such cases, they will be playing into the hands of their enemies.

Copper.

The position of the copper market is far from being brilliant, and in the last week or two prices have gradually slipped to a lower level, with very little new business of a general character about. The production has been cut down to a phenomenal extent in all parts of the world, the average rate of reduction being fully 50 per cent., while a number of properties have ceased operations entirely, and there is good reason for believing that those at present at work will be put on shorter time yet, should it appear that there is an excess of metal being produced. At the moment it is too soon to be certain as to the position in this regard, but a close watch is being kept on events in this direction, and prompt action may be expected, should it turn out that the foundation of the market is still weakening. The extent to which output has been stopped, and the fact that so far it has not had any effect of a favourable character upon selling prices, is regarded with some apprehension for fear it betokens a still greater reduction in consumption than had been thought possible when the programme of restriction was arranged. The future is certainly obscure, but this much, at least, may be remarked, that at present, holders of commodities all over the world are much more concerned with turning their holdings into cash, than with any other consideration, and this must tell upon the course of prices. The leading American producers are not pressing material upon the market, for they appear to hold to the opinion that it is only a matter of time before the lessened quantity of material available will make itself felt; but this is a matter of faith, and there is not too much of this virtue about at this juncture. The main requirements which have come forward during recent days have been from the ammunition and war equipment makers, all of whom hold large State contracts on which they are working night and day, and these account, no doubt, for a heavy consumption of the metal, but the practical drying up of ordinary trade requirements is responsible for a very important contraction in the world's needs.

In all branches where the operations of peace are concerned, this indeed is an outstanding feature. The trade buying of all descriptions of manufactured copper is thus limited of course, and though a few orders have been booked from Colonial railways, &c., the total business doing is small. There are still material difficulties to be faced, too, in connection with the shipment of goods to markets overseas. Not only is there risk of capture by German cruisers, but there are many and manifold difficulties to be negotiated here in connection with the obtaining of permits for the goods to be cleared for overseas. This is a real trouble, and one which is much exercising the minds of makers and merchants, who find themselves rather awkwardly placed in connection with the execution of business for the East and elsewhere. The position, however, tends to improve in this respect. The outlook for the market is still indeterminate so far as the near future is concerned, though when financial conditions improve, and the reduced output can make itself felt, there will be a fresh complexion put on affairs no doubt. Meanwhile, as ever, war and its immediate consequences are decided bear points.

LARGE INDUCTION MOTORS: SOME FEATURES OF MECHANICAL DESIGN.

By G. MOORES, B.Sc.Engineering.

I. *General Arrangement and Ventilation.*—One of the first points to be considered in deciding upon the general mechanical arrangement of a large induction motor is that of ventilation. The determination of the exact output of a new large motor for a given temperature rise is a matter of such uncertainty, that it is necessary to use every possible care in the mechanical design to see that efficient ventilation is provided for. Not only has the arrangement of the machine itself to be considered, but it is important to take into account also the external conditions under which the machine has to operate, as these may have a great influence on the performance of the motor.

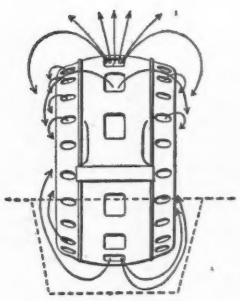


Fig. 1.

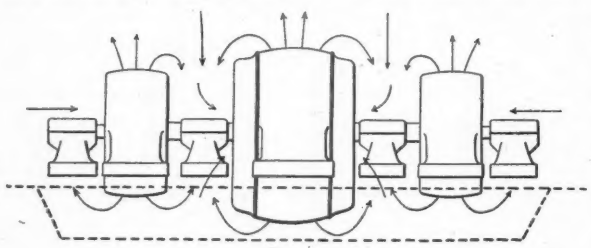


Fig. 2.

External Conditions.—The state of the atmosphere, the temperature and movement of the air around the machine, the proximity of other machines, the relative position of the machine with respect to surrounding objects, and the disposition of the air inlets and outlets of the motor, are all factors which affect the temperature rise and hence have a limiting influence on the output. It is advisable, if possible, always to locate a motor so that it can easily be supplied with plenty of fresh cool air, either by means of externally-fitted fans or by enclosing the air passages to the motor so that the fanning action of the rotating part, possibly with the assistance of internal fans, will cause cool air to be drawn in directly from outside or from some relatively cool part of the building in which it is situated.

It is also important to allow the hot air from the machine to escape easily, and to ensure that there is no possibility of its returning by a short path to the air inlet of the motor.

These considerations all affect the design of the motor itself. In the case of motors of small or moderate size, arrangements can, of course, be made to lead the air to and from the motor by means of pipes, for which arrangement the "pipe ventilated" type of motor is specially designed. For the largest motors, however, this is hardly feasible. These machines are usually of the "open" type, hence we find the arrangements made for their ventilation very varied and often very inefficient. An example of this is given by the case of an ordinary open-type motor placed in the usual way over a pit—fig. 1. The air enters at the sides through the end shields, and is thrown out at the periphery of the stator all round the machine. The result is that the pit becomes filled with hot air, which rises, and instead of escaping is drawn by the draught into the machine again, thus causing a current of more or less heated air to circulate continuously through the machine.

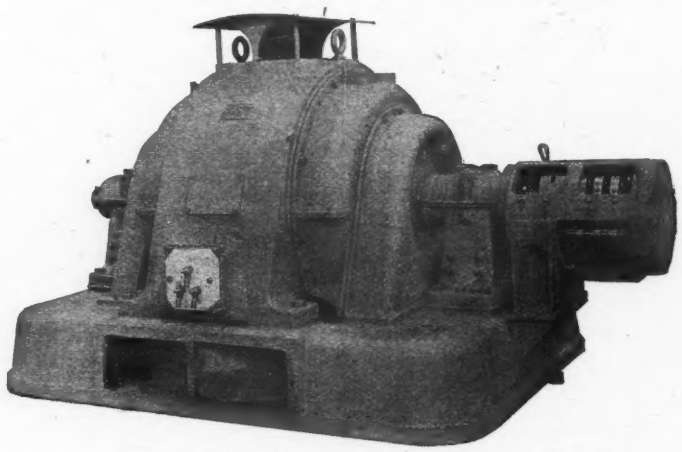


Fig. 4.—B.T.H. 700-h p. Enclosed Ventilated Motor.

Or, consider again the not uncommon case of fig. 2—a motor driving a generator on each side of it. In this case the motor may draw in not only the heated air escaping from itself, but also that from the two generators.

To overcome such difficulties as these, the practice is becoming largely adopted of putting outlet ventilation holes only in the upper part of the stator frames, as shown in fig. 3. The heated air then, instead of accumulating in the

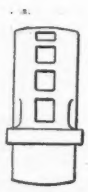


Fig. 3.

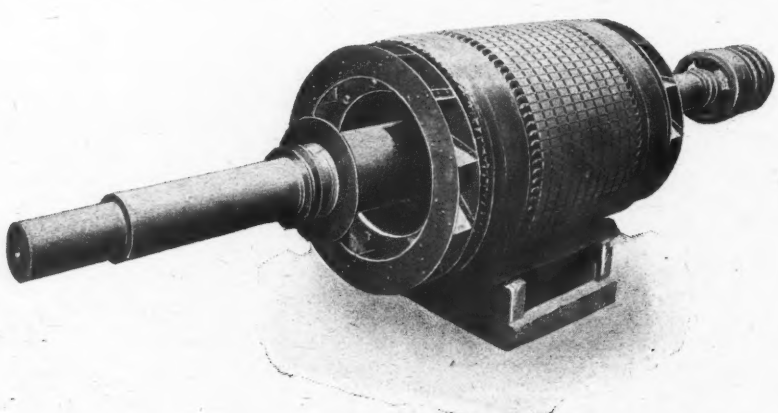


Fig. 5.—Rotor of 700-h.p. Motor.

foundation or around the lower part of the machine, whence it would rise and re-enter the latter, can more easily escape upwards away from the motor.

Frequently the additional precaution is taken of constructing the foundations in such a manner as to ensure a plentiful supply of fresh air being obtained in them; for instance, by tunnelling to the pit from the outside of the building. When this is done, the motor, even if of the ordinary open type, is generally sufficiently well ventilated. A still further improvement may be effected, if necessary, by building the motor with enclosing end hoods, which fit over the end shields, and have an opening at or below the surface of the bed-plate, thus ensuring that all the air which enters the motor comes from the pit, or, at least, enters at the base of the machine, and by fitting enclosing covers over the bed-plate, or by specially constructing the latter, it can be further ensured that the heated air from the machine is separated absolutely from the cool air in the foundation from which the motor draws its supply for ventilation.

An example of the latter type of construction is shown in fig. 4, which illustrates a 700-H.P. induction motor by Messrs. The British Thomson-Houston Co. In this machine fans on the ends of the rotor—clearly shown in fig. 5—draw air through the ducts shown in the baseplate, drive it through the stator windings and discharge it through the opening in the top of the frame.

Internal Arrangement.—The arrangements which are made within the motor itself for obtaining good circulation of air are very varied, and such uncertainty exists as to the efficiency of various methods, that at the present time it may almost be said that the internal arrangement of the ventilation is a matter of individual taste. Experiment, however, seems to lead to a few conclusions which may serve as some guide in design. To take the most usual arrangement in which the air drawn through the rotor core cools both it and the stator core, and air drawn through the rotor windings cools both rotor and stator windings, the following conclusions seem to be indicated by experience. In the first place, it is generally of very little use to attempt to augment the amount of air flowing through the rotor core by fixing fans on to the motor shaft near the air inlet of the machine with the object of forcing air through the rotor. Fans of both the screw-propeller and centrifugal types have been tried in this connection, and whilst the latter were in particular cases of slight advantage, the former were generally a decided failure. Cases have been observed, however, where fans even of the latter type impeded rather than assisted the ventilation, and the performance of the motor was improved by removing the so-called fans.

The best results are usually obtained by making the fanning action of the rotor core as great as possible by supplying it with ample ventilating ducts and by fixing suitable air guides.

There are two faults in particular which easily occur in designing the ventilation of a motor unless care is taken to

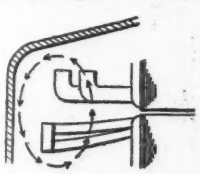


Fig. 6.

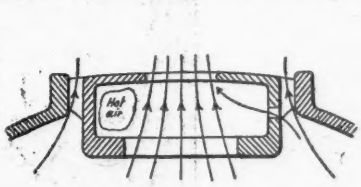


Fig. 7.

guard against them. The first is that of the formation of local air currents within the machine. An example of this is shown in fig. 6. Here the air thrown out by the centrifugal action of the rotor winding meets with a certain amount of resistance due to the stator winding and possibly narrow outlets through the stator frame, and instead of passing out it is deflected back again and re-enters below the rotor winding, thus forming a current of heated air which continuously plays on the two windings.

The second condition to be guarded against is that of the existence of pockets of heated air owing to the machine being so constructed that in certain parts of it the air does not get renewed at all. This fault is generally quite easy to overcome, once it is observed. Fig. 7 shows an example of it. It represents the air emerging from a stator frame. The left-hand side of the figure shows the manner in which a hot-air pocket may be formed, and the right-hand side shows how it may be prevented by drilling a few holes in the frame and allowing some of the air from the windings to pass through.

It is sometimes found when a machine is built that whilst sufficient air passes through it as a whole, the air is not well distributed, with the result that the core, say, may become overheated whilst the windings are well below the limit in temperature. Fig. 8 shows a method of construction designed to overcome this difficulty as well as that of

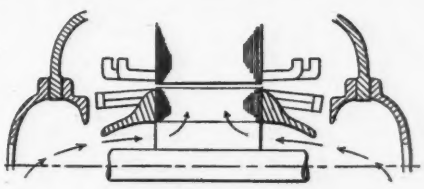


Fig. 8.

local air currents. It will be seen that the "tunnel" through the rotor core is extended almost to the ends of the winding, and this by reducing the cylindrical open area beneath the winding prevents an excessive volume of air being drawn through the winding instead of through the core. The possibility of the formation of local air currents is at the same time prevented by the fitting of baffles as shown. It will be seen that a current of air similar to that in fig. 6 cannot be formed with this method of construction.

Although fans fixed on the shaft designed to force air through the rotor are usually of very little assistance, on the other hand, fan blades attached to the rotor as shown in fig. 5, or even quite small blades attached to the rotor winding, with the object of cooling the stator winding, are usually of considerable value.

It is intended here to deal only with features of interest in the mechanical arrangement of machines; for valuable information dealing with the subject of ventilation from a more theoretical point of view the reader is referred to a paper on "Heat Paths in Electrical Machinery," by Messrs. Symons & Walker, contained in Vol. XLVIII of the *Journal* of the Institution of Electrical Engineers.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

German Culture.

I have been attacked for suggesting that a very scientific family of German origin, and mostly still German subjects, may not be altogether too friendly to this country.

These particular people have not, so far, given any indication of their sentiments; but let us hear what is written by the renowned Dr. Lenard, Nobel Prizeman, Fellow of the Berlin Academy of Sciences, Professor of Physics at Heidelberg University, and well known throughout the world as the discoverer of the Lenard Rays, the precursors of those of Röntgen.

Here is an extract from what he writes in the *Hamburger Fremdenblatt*:—

"Down, then, with all consideration for England's so-called culture! The central nest and supreme academy for all hypocrisy in the world, which is on the Thames, must be destroyed if the work is to be done thoroughly.

"No respect for the tombstones of Shakespeare, Newton and Faraday! The spirit of these great men has long ago passed into the souls of the living—and more so in those countries which England is trying to put down than in England itself. Down with all this! We must realise that there can be no real peace with a highwayman until he has collapsed or has been destroyed."

Here is another fine chance for thorough-going pro-German apologists.

A. A. Campbell Swinton.

London, S.W., *September 22nd*, 1914.

C

German Electrical Success: A Suggested Inquiry.

[Although we felt compelled last week to suggest a closing down of the correspondence on "What Constitutes a British Firm?" we are quite prepared to devote space to helpful and constructive suggestions concerning the present situation and methods for dealing with it. The following is an extract from one such letter received before the writer was aware that the "Correspondence" was closed.—Eds. Elec Rev.]

The general trend of this correspondence makes it appear obvious that much of it has been animated by trade jealousies rather than by either patriotism or sound commercial instinct.

Supposing the outbreak of war between the same countries had taken place in the earlier stages of the electrical industry, in which so much valuable pioneering work was done by Germany, it seems to me the progression of this industry in the United Kingdom would have been put back a number of years if the advice of your correspondents to-day had then been acted upon.

If German competitors have succeeded in capturing a big slice of the electrical business of the United Kingdom and her Colonies, it would be much better for us to probe the commercial and economical causes, and immediately to set about putting British electrical industries on the soundest possible basis to enable them to compete successfully for future trade with all comers, rather than to try and set up a National bias, which is bound to die out after the war is over. British electrical manufacturers undoubtedly now have a fine opportunity, as, between sentiment at home and ruinous financial conditions in Germany, they will have a considerable breathing space in which to set their house in order.

In conclusion, I would appeal for calmer and more reasonable consideration of this question than has hitherto characterised some of the correspondence on this subject.

Dublin, *September* 23*rd*, 1914. **T. G. A.**

Arbitrary Action of Public Authority.

I think Mr. Purse's letter in reply to mine must be an example of those written in haste to catch the midnight post, to which you referred a week or so ago. The words "cowardly" and "sneak" are not such as a gentleman should use in a calm moment in objecting to a communication to the Press being anonymous. When I say that I am one of the wicked manufacturers in question, it will be evident that it would be absurd for me to reveal my identity. The authority in question will, no doubt, be in the market again sooner or later, and what chance should I have of obtaining an order if the inquirer knew I had written the letter which has aroused Mr. Purse's ire? The inquirer is almost certain to have seen the letter and could not fail to recognise the matter.

Mr. Purse omits to say whether he considers the authority acted correctly or not. I do not wish to be drawn into a discussion as to whether the I.E.E. conditions of contract are fair or unfair, but it is indisputable that they are much more equitable than some of the conditions (including those referred to in my letter) drawn up by purchasers. They do not, for instance, appoint the contractor sole arbitrator.

Being, as I mentioned above, a manufacturer, it is not within my province to reply to Mr. Purse's allegations as to the manner in which the I.E.E. conditions were adopted.

Mr. Purse apparently suggests that if we manufacturers are not careful, steps will be taken—presumably by the Government—to put us into what he considers our places. If we never do anything worse than insist on I.E.E. conditions, I think we can contemplate this possibility with equanimity. Meantime, I expect few people will agree that insistence upon these conditions justifies the placing of an order abroad.

Advocate of Patriotism in Time of Peace.

Capturing German Trade.

Are we not allowing ourselves to run away with this fascinating thought regardless of prudence?

No one doubts but that this country has the opportunity of benefiting for the present by business being diverted to her which would previously have been placed on the Continent, and that new markets will to some extent be available of which she has previously been deprived due to the unfair competition emanating from Germany. But the numerous suggestions of capturing German trade by taking up new lines of manufacture would seem to be largely ill-considered.

I venture to predict that six months after the conclusion of peace, the business community of this country, lacking all sense of patriotism where commerce is concerned, except in so far as patriotism lies in buying in the cheapest market regardless of all considerations excepting price, will resume buying German goods, if available. And only in the event of the Teuton ceasing to exist as a trading nation would there seem to be any justification for capital being invested in new industries as long as our policy offers capital no protection against unfair competition from outside.

For instance, whatever arguments may fairly be advanced in favour of encouraging foreign capital being invested in this country for manufacturing purposes, and to the extent of such operations treating these concerns as British, no arguments can surely be advanced for allowing, as we have done, German-controlled companies, by trading under the British flag to act primarily as stalking horses for their German factory, and under cover of the British company accepting British and Colonial orders which keep employed in Germany often many times the number of men employed in Great Britain. And yet our policy is to accept such acts as advantageous to the country.

Apart from the larger question of Free Trade *v.* Protection, manufacturers in this country will require to feel that the commercial policy of the country offers some protection before being able to induce capital once again to flow freely into her industries.

That the terms of peace, when they come to be drafted, may result automatically in removing some forms of unfair competition would not be surprising; but until this comes about it is difficult to see what security can be offered to capital in attempting, under our present policy, the creation of new industries.

E. J. Fox.

London, S.W., *September* 28*th*, 1914.

Is "Earthing" an Extra?

This question of "Extras" is as old as the hills with a certain class of wiring contractors.

They contract to lay cables and wire buildings with the best material, and finish in a workmanlike manner. When the work is finished, in what he pretends to think a proper manner, the contractor is quite surprised when told he must have continuity with his conduit, and cable armouring properly earthed, before he can have the power switched on. After a lot of hot words, heard and unheard, he earths the job to pass the requirements of the Home Office and the local authority.

Now we get to Stage 2 of the farce.

The consumers have been protected so far by the Home Office and the Local Supply Co. Why do not they make examples of the men who are in the habit of dissecting essential parts of the contract, and serving them up again in the form of extras? An authorised plumber might just as well start to charge an extra on a contract job for the red lead used on his pipe joints.

My advice to engineers up against this injustice of "Extra for Earthing," is to let the contractor sue for his extra and give himself the publicity he deserves, which I have no doubt will have the desired effect on his future orders, if he is fortunate enough to get any.

Inspecting Engineer.

September 26*th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Ediswan Heaters.

With the near approach of cold weather, the Edison & Swan United Electric Light Co. draw attention to the subject of electric heating, business in which they feel will be but little, if at all, affected by the war.

In particular they draw attention to their "Royal" heater, illustrated in fig. 1, which is constructed at their works at Ponder's End, Middlesex.

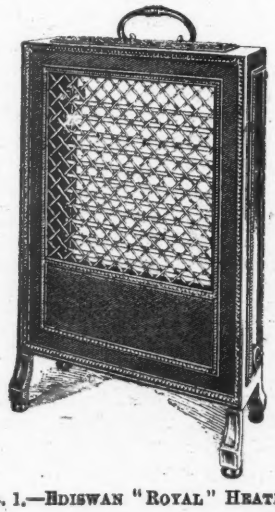


Fig. 1.—Ediswan "Royal" Heater.

The apparatus shown is constructed in brass, fitted with quartzalite heaters and is specially suitable for use in drawing rooms, boudoirs, convalescent homes, hospitals, &c.

A Converted Bar Mill.

In a recent example of a conversion from steam to electric drive, the mill was previously driven direct by a horizontal steam engine. This mill has three high roughing rolls and two high finishing

rolls and guide train, and is engaged in rolling iron and steel billets varying between 100 lb. and 200 lb. in weight down to flat rounds, &c.

To convert to electric drive the steam engine was removed and replaced by a 30-ton fly-wheel, coupled to the mill shaft and rope-driven from a 500-volt direct-current compound-wound "Witton" motor of 300 H.P., running at an average speed of about 220 R.P.M. To enable the fly-wheel to do its share of the work, the motor was compounded so as to have approximately a 20 per cent. drop between no load and full load.

The motor is controlled by a switch panel provided with main switch, circuit-breaker, ammeter, speed regulator and multiple switch starter; with the exception of the circuit-breaker, which is at the top of the board and out of reach, the switchgear is fitted with protecting covers, and it is also interlocked so that the circuit-breaker, switches and starter must be operated in the correct sequence whereby accidents are prevented. In addition to this switchgear a push-switch is provided near the rolls by which the motor can be stopped in an emergency.

One of the owners recently said it was found (with the motor) that an increase of 20 per cent. in output was obtained, partly due to the greater regularity with which the train was driven, and, further than that, the quality of the work was better, due to the more regular speed which gave a more regular size of bar rolled. There was also a considerable economy in the matter of labour and in lubricating materials.

The energy for driving this motor is generated from exhaust steam, so that the power is obtained very cheaply. The electrical plant driving this mill was supplied by the General Electric Co., Ltd., of Witton, Birmingham.

Simplex Conduit Fittings.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have forwarded us one of their mailing cards referring to the Simplex outlet cover inspection bends and tees, which provide

Figs. 2 and 3.—Special Simplex Conduit Fittings.

an easy means of branching off from the main run of conduit to a light point and switch, and result in an exceedingly neat junction. These are made in $\frac{5}{8}$, $\frac{3}{4}$ and $\frac{7}{8}$ sizes, and are illustrated in figs. 2 and 3.

Aster Generating Set.

The accompanying illustration shows a new type of direct-coupled generating set just put on the market by the Aster Engineering Co. (1913), Ltd., of Wembley, Middlesex. It consists of a four-cylinder high-speed single-acting petrol engine of 8 H.P., driving a 4½-KW. dynamo, with a water-cooled radiator mounted on the yoke of the latter. A large number of these have recently been supplied to the Government.

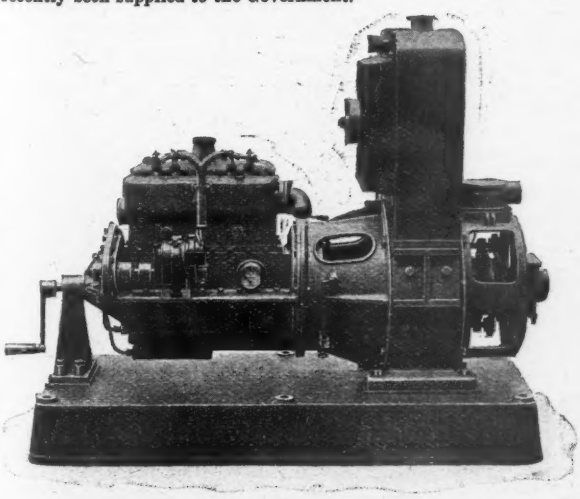


Fig 4.—Aster 4½-KW. Generating Set

As will be seen, the design is exceptionally neat and workmanlike; we understand that extremely silent running is a special feature of the set, which also runs without vibration. The speed is 1,225 R.P.M., and the gross weight of the set about 1,300 lb.; it is suitable for country house and yacht lighting, kinematograph theatres, &c., and can be provided with a paraffin carburettor or run on town gas if desired. A sensitive governor is fitted, and an oil circulating pump; the crank-case is of aluminium

REVIEWS.

Photo-Electricity. By A. L. Hughes, D.Sc., B.A. London: Cambridge University Press. Price 6/- net.

This work gives an account of electrical effects due to the action of light, so far as these have been ascertained. It is true that the whole subject is still very much in the experimental stage; nevertheless, a sufficient quantity of data has now been obtained to render a concordance of the results desirable and valuable. Practical men should remember that future great discoveries are likely to lie along the borderland of the sciences of physics, chemistry and electro-technics, and that for this reason they should keep a very observant eye upon the results of researches into this region. A great amount of experimental work is now being carried on all over the world, and we are indebted to the author of "Photo-Electricity," amongst others, for simplifying such results as have been obtained up to the present and putting them into readable and consecutive form.

Hertz, in 1887, was the first to note that a spark passed between metallic terminals in air more easily when light from another spark fell on the negative terminal. This effect led to a number of investigations by Hallwachs, Elster and Geitel, and others who found that electrified metallic conductors lost electrification when illuminated by a suitable source of light. It was afterwards discovered that the illuminated metal could lose negative but not positive charges. If the metal were initially insulated and uncharged, then it acquired a small positive charge, but the potential to which it rose did not exceed a volt. The effect on these metals was found to be due to ultra-violet light alone. With the alkali metals, on the other hand, experiment showed that the light of wave-lengths within the range of the visible spectrum as well as ultra-violet light was effective. The emission of negative electricity from an illuminated plate is now generally known as the photo-electric effect, and the theory which at present holds the field states that when light of suitable wave-length falls upon the surface of a metal sudden and violent changes occur to some of the atomic systems in the line of fire—changes so disturbing that one of the electrons leaves the system altogether. This electron—which is a negative unit of electricity and the smallest quantity of matter known to exist, having a mass but one-eighteen-hundredth part the mass of the hydrogen atom—alone can escape, and the positive charge necessarily associated with the parent atom remains in the surface. In the presence of a gas these electrons become ions. Experimental research also makes it pretty clear that each substance has a definite wave-length at which its photo-electric effect starts. Longer wave-lengths are useless, while all wave-lengths shorter are effective.

The author considers the ionisation of gases and vapours by ultra-violet light. Up to the present, experiments have been chiefly concerned with establishing the fact of this ionisation. Many questions still remain unanswered, such as the effect of temperature, pressure and mixture of gases. He then discusses the velocities of emission of photo-electrons and the total photo-electric effect, the latter including applications to radiometry, the results of temperature variation, the effect of an electric discharge on sensitiveness, and fatigue in presence of a gas and in vacuo. Much work follows on the photo-electron effect considered as a function of the frequency and state of polarisation of the light, and then there are chapters on the photo-electric properties of thin metallic films and of non-metallic elements and inorganic compounds. A few short chapters on dyes, on fluorescent and phosphorescent substances, on positive rays produced by light, and

on sources of light used in photo-electric experiments conclude the work.

The book goes very thoroughly into all modern experimental research related to its subject, much of this research being due to the author himself. The whole question of the action of light on the electrons of the atom is important and may have valuable and far-reaching results, and we consider the author is to be heartily congratulated on the lucid manner in which he has dealt with it.—W.J.C.

Water Turbines. By Ing. Johann Hallinger. Munich: Verlagsanstalt Joh. C. Huber.

With characteristic Teutonic thoroughness, Herr Hallinger sets out opposite to the German text of his treatise excellent translations in both French and English. His object, apparently, is to show that most hydro-electric power stations are not laid out to the best effect. Nowadays, certainly, it does happen that with larger machines proportionately higher building costs have to be confronted. To enable the proportion to be adjusted the author describes new hydro-electric buildings that are 40 per cent. cheaper than those with the ordinary layout. Not only this, it is claimed that the installation of the machinery is simplified and its working capacity increased.

Briefly, the idea is to do away with right-angled gearing between the turbine and the dynamo and to have both units direct-coupled and all in one plane. Not only one, but two turbines running in tandem, or even three all on one shaft, can be used, an arrangement that Herr Hallinger claims "enables turbine and dynamo constructors to produce the most practicable and cheapest sets of machines." The row of turbines is placed at right angles to the flow of water, thus giving a simpler building than if they were parallel with the stream. The new arrangement is claimed to be suitable for small or large power stations with falls of from 10 to 100 feet.

The author's monograph is replete with diagrams, plans and photographs of actual stations built on these lines, and calculations showing the savings effected in construction and operation, and is worthy of study by electrical engineers interested in water power schemes.

Electro-Thermal Methods of Iron and Steel Production. By John B. C. Kershaw, F.I.C., with an introduction by Dr. J. A. Fleming, F.R.S. London: Constable & Co., Ltd. Price 8/6 net.

Electric furnaces for use in the metal industry seem at last to be coming to occupy the position that common sense dictates they must ultimately reach now that this type of furnace has proved its importance in conjunction with the open-hearth furnace, Bessemer converter and blast furnace.

In his very useful volume on this subject, Mr. Kershaw wisely directs the attention of his readers towards the practical application of electric heating in the iron and steel industry rather than to the theory of the subject which, after all, would interest only a small class—the designers and constructors of large furnaces. By keeping to accounts of actual installations—often very difficult to learn of, by the way—and of methods of operation of the various types of furnaces described, and by giving summaries of working costs and tests of raw materials and finished steel, the author has rendered a useful service, particularly to the average steelmaker.

Mr. Kershaw has no axe to grind, so he is able to describe and discuss the many types of furnaces and processes quite impartially. By virtue of his position in this respect he has been quite successful in securing the active assistance of the makers or inventors of practically all the well-known electric furnaces, such as the Héroult (the recent death of the inventor of which is so much to be regretted by the electrical and metallurgical world), Girod and Stassano. These are the most widely used furnaces, there being over 50 of the former and 20 of the Girod type now in successful operation. As might be expected, the lack of suitable water-power causes this country to occupy a low position in the lists prepared by Mr. Kershaw to show where the various types are being employed. Germany would seem to be in the forefront, with the United States taking second place. Both of these countries are large users of electric steel rails, five thousand tons of which have been laid on railway tracks out in the Western States of America, and it is reported that not a single electric rail has failed. Similarly good reports have been received by the author regarding German rails made from electric steel, and he surmises that "the savings resulting from their longer life and greater freedom from breakage may more than counterbalance the extra cost of the electrical treatment." Such steel must obviously be more costly than ordinary steel, since it is simply Bessemer or open-hearth steel subjected to special heat treatment in a neutral atmosphere. Rail steel and construction steel is usually produced in the Héroult type of furnace. As regards cost, Mr. Kershaw, speaking of the latter type, makes the interesting statement that "at Sheffield, where the cost of electric power (as generated from coal by the Corporation Electricity Works) is .48d. per kw.-hour, the cost of refining molten metal will probably run between 4s. 6d. and 8s. 6d. per ton, and when cold scrap is used as raw material for the electric furnaces, the costs will rise to between 19s. and 21s. 6d. per ton." Other types of electric furnace described are also being used in Sheffield, particularly in the manufacture of the alloy steels required for tools and projectiles, for which Sheffield is justly famed, and which it is hoped will at least be equally as satisfactory, both technically and financially, as the steel made by the older methods.

Steam Pipes: Their Construction and Maintenance. Manchester: The Vulcan Boiler and General Insurance Co. Price 1/-.

This book contains the digested experience of a boiler insurance company in the important detail of steam pipes. Accidents to steam pipes have been far too frequent for anyone to entertain longer the opinion that pipes are a negligible item in steam engineering. Until quite recently steam pipes were of cast iron. As pressures rose they remained of cast iron, but were merely made thicker. For modern pressures the material is unsuited, and pipes have for some years been made of wrought iron or steel, but the valves and junction-pieces were still of cast iron, but very thick. Especially with the high temperatures that go with high pressures and with superheat on the top of these, the stresses in steam pipes have been increased in a double ratio, and expansion has now to be specially provided for. Steam pipes must, says this book, be regarded from six special points:—A sufficiency of area to carry the steam without undue loss of pressure-head—a matter which entails cost and loss of heat if overdone. Full discharge of water must be provided for; expansion and contraction must be allowed for without producing creeping; and, without sacrificing these, the pipe must be supported and provision made to prevent vibration and strain from any cause; the pipes must be strong enough to carry the pressure within them, and they must be protected from heat losses.

The first consideration is a matter of proper choice of velocity. Loss of heat is a matter of velocity very largely, but larger diameters than necessary cause loss of heat; the two losses must be worked out to give a minimum net loss, and

some extra pressure loss may be allowed for short periods for a big demand, rather than incur the constant loss of heat from larger pipes half employed.

The calculated velocity for steam at 200lb. should, it is said, be limited to 60ft. per second, and exhaust pipes may carry steam at even 350ft. per second.

Experiment is called for to determine the losses due to the friction of excess velocities, rough surfaces, changes of direction and excessive condensation. As to drainage, it is recognised as foolish to attempt the obsolete practice of draining back to the boiler, for what can gravity effect in a nearly horizontal pipe as compared with the drag of the rushing steam? An illustration is given to show a case which would cause water hammer. There are some good illustrations of water separators and comment on their faults and virtues, a specially commended one being inclined and apparently capable of fulfilling all that is claimed for it.

As to material for pipe, cast iron is rightly condemned. It is neither elastic nor fully sound and rarely of even thickness all round. It is permeable to liquids and is liable to ultimate disintegration, especially with superheated steam. It is also liable to increase in bulk when heated to 530° F. and even to 430°. Nor is copper a safe metal, especially when brazed; and copper loses half its strength at 700° F. Steel only remains, and even this is not always safe for lap-welds are apt to be cold shut. Many pipes are riveted. Even if this reduces the nominal strength of a pipe one can at least know that it can be relied upon up to what percentage of strength rivets will give.

Between 32° and 212° cast iron expands 1-900th. Between 32° and 366° it expands 1-500. Hence the rule for expansion in inches E = difference of temperature Fahr. degrees × length in feet ÷ 13,500. For steel the divisor is 11,000 to 14,000, and for copper 9,000. Thus the expansion for steam at 150lb. works out at 2.67 inches per 100 feet, and the same steam superheated to 500° would cause an expansion of 4 inches.

It is advised to make each section of pipe short by one-half the calculated expansion.

Illustrations are given of expansion bends and other details. Some steel alloy is hoped for which will have a very low co-efficient of expansion. Nickel steel—invar metal—is already known to have an expansion of nearly 0. But sad to say, invar will not stand high-temperature steam. It is an alloy of iron 64, nickel 36, and its expansion is not quite nil, but one-twentyeighth that of plain steel and survey tapes may be used if made of invar without any need for temperature correction.

Chapter VI deals with jointing and materials for the same, and a warning is sounded against attempting to remedy a leak by the spanner—a risky proceeding unless done by a man of experience with a new joint at a pressure much below the normal. Once set, it is criminal to carry out such tightening of a joint under pressure.

The next chapter treats of suspension and support by sling rods and brackets, and gives a table for suspension springs of ¼in. to ⅝in. steel such as are suitable to give a slightly elastic suspension at each hanger. Such springs should be ferruled as a guard against overload. A section deals with vibration. Rollers, good in theory, fail in practice very frequently. They ought to be self-clearing of dust in our opinion, and their axles ought to run on raised paths without control except at the end of the possible run. They should not run in bearings, which may rust up.

It is probably better practice to have rubbing-strips secured to the pipe, the strip to run on a fixed bracket. Such strips have considerable friction yet are free to move while not allowing vibration.

In Chapter VIII exhaust pipes are treated, and a caution is given as to the dangers of all pipes under external pressure, or filled with vacuum as it is quite usual to say.

On valves it is said, and we are glad to note it, that valve cases or bodies should be of steel. Otherwise this chapter appears to be a description of the valves of one maker. The conical ajutage valve, first described in the columns of the Elec. Rev., is here credited to the Messrs. Hopkinson. What they did was to put in the lower projection to make an eddy preventer, but the original invention of conical ajutage valves was not theirs, but was made by an engineer on the ground that the use of full-sized valves was too costly, and that steam would pass rapidly through small-way valves without serious pressure loss.

The Calculus for Engineering Students. By J. Graham. London: E. & F. N. Spon, Ltd. Fourth Edition—Price 5/- net.

The processes of differentiation and integration dealt with under the designation of "The Calculus" were devised independently by Newton and Leibnitz as the simplest and most appropriate means of dealing numerically with problems of velocity and acceleration, of particles singly or aggregated into the masses we call material bodies, that is to say, of reducing them to forms susceptible of calculation. Every engineer has to solve such problems in his professional work, and the engineering student therefore has to learn to solve them. By restricting the field of his operations within somewhat narrow limits he may solve a considerable number of such problems by what mathematical teachers of a past generation used to call elementary methods, but which were in reality incomparably more laborious than the simple and more appropriate methods of the calculus. But the Cambridge teachers had made a fetish of the calculus. It was the formal portal giving entrance to the Higher Mathematical Analysis. Cambridge students were classified into men who understood the Differential Calculus and the men who did not, and before they were allowed to enter these sacred portals they were compelled to learn and practise the many complex and devious methods devised by teachers for avoiding the use of the far simpler methods invented by the two great master-builders of modern dynamics. The sacred ground was further fenced against the common herd of practical men who studied dynamics, not as a system of mental gymnastics, but for the purpose of applying their knowledge to the more prosaic end of earning their bread by applying their knowledge of nature to the satisfying of the material wants of their fellows. For the elementary text-books of dynamics were written for the elementary work of the mathematical schools, while the more advanced treatises were to all intents and purposes mere exercises on the calculus, largely taken up with the solution of problems devised merely as such exercises, and bearing no relation whatever to the observed laws of nature. Long and strenuous efforts on the part of Professor William Thomson, afterwards Lord Kelvin, and Professor Tait, admirably seconded by James Clerk Maxwell and others, ultimately overthrew this artificial system, took us back to Newton's methods, and brought the calculus down from the strictly guarded pedestal on which it had been posed as an object of veneration to make it once more a useful tool for the study of nature, as intended by its makers.

Books of the type of which the present volume is a very excellent example are among the fruits of this work. It is written for the average type of engineering student who has no aspirations towards becoming a mathematician, and who studies the calculus solely with the view of acquiring such a working knowledge of it as will enable him to carry out such calculations as he may expect to have to deal with habitually in his professional work, and to follow intelligently such professional treatises and

original papers as he may find it to his advantage to study. And the student who works through this little volume will very seldom find himself at fault in either respect. The present edition has been so much enlarged and so extensively re-written in the light of the author's ever-growing experience of the requirements of his engineering pupils as to make it practically a new work, and yet better than a new work, for every page, both of text and of examples to be worked out by the reader bears evidence to its being no mere compilation, but a true growth, developing in response to the stimuli furnished by the needs of the engineering students at the Finsbury Technical College.

Two brief introductory chapters recapitulating algebraical, trigonometrical, and geometrical formulæ and results of primary import to the students of the calculus, must be regarded by him merely as recapitulations, and not as sufficing for foundations of his knowledge of the subjects. Nine chapters are then devoted to the development of the simpler aspects of differentiation as required by the average engineer, followed by six on integration. Chapter XVIII deals with the expansion of periodic functions, so essential to the electrical engineer, in which Fourier's Theorem is very simply dealt with as a tool for use, omitting, of course, all demonstration of its validity and of the limitations of its use, which the engineering student must take on trust from the mathematician unless he continues his mathematical studies to the extent of becoming himself a mathematician. Then follow chapters of practical applications, with a useful one on the use of Hyperbolic Functions, and five chapters on the simpler types of differential equations with which the engineer mainly has to deal, and which can be dealt with by the aid of a merely elementary mathematical equipment. Two chapters on applications of the calculus to functions of more than one variable, including problems of maxima and minima, a collection of well selected miscellaneous examples, and a good index, conclude a little handbook which may be confidently recommended, both to the average engineering student who will rest content with the knowledge of the subject which can be acquired by conscientiously working through it, and to the exceptional student, who may use it with advantage as a stepping-stone to a deeper and wider study.

G. W. de T.

MECHANICAL CHARGING OF BLAST FURNACES.

By N. KAPP (Birmingham.)

(*Abstract of Paper Contributed to the* Iron and Steel Institute, *September*, 1914.

In order to convey large quantities of material in a given time, the conveyor must run continuously in one direction without stopping, the empty vessels returning to be refilled. The only way to get a continuous stream of charging material from the bunkers to the hoppers without recharging is to split up the charge into a number of small units, and to run them in an unbroken line past the coke-ovens and bunkers, up to the hoppers, and back again to the charging stations.

The chain conveyor is bound to one plane. If it travels up to the furnace mouth and down to the charging platform, it cannot travel sideways as well. But the bunkers or coke-ovens are probably situated in quite another part of the ground, and to reach them the conveyor would have to pass round many corners. This applies more especially to old existing plants in which new methods of conveyance are to be installed. In the case of such works, which will be the most usual case in England, the conveying plant must possess the greatest adaptability to the local conditions. The advantages of a bucket conveyor can, however, be retained by splitting up the chain into separate detached links, and supplying each link with motive power of its own. Such an arrangement is the electric telpher. Here we have a means of conveying material from the most distant and inaccessible places in an unbroken line to the furnace mouth.

The principle of the plant is the same as the old miner's tub pushed by hand, the men who pushed them being replaced by small electric motors which act entirely without supervision from the moment they are sent on their way from the coke-ovens and ore bunkers to the moment they arrive at the hopper platform and range up round the hopper. All that is left for the men to do is to knock up a catch and empty the skips into the hopper, pull a switch and send the empty cars on their way back to the bunkers.

I will confine my description to the Bleichert system of electric telphering for charging blast-furnaces.

The telpher consists of a traveller fitted with an electro-motor, which receives current (usually direct current at 110 volts) by means of a bow collector and a line wire. The skip is suspended from the traveller by a couple of hangers, and is slung in pivots in such a manner that it is in unstable equilibrium when full, and therefore upsets as soon as the catch is knocked up. When empty, however, it is unstable in an inverted position, which makes it very easy to right the skip and throw in the catch. The working of the line being entirely automatic, it is necessary for the safety of the cars to introduce a block system, similar to that on a railway, but entirely self-acting.

For this purpose the telpher line is divided into a number of sections, each section receiving current over a switch. The switches are of a drum type, and are turned by the passing of a car in such a manner as to cut off the current from the section it has just left. At the same time the switch gives current to the section which was deprived of current before, so that there is always a dead section behind every car, and no second car can approach closer than the length of one block section. The number of these sections and block switches depends upon the output of the line. Greater output means more telpher cars and more sections, so that the cars can move closer together. Herein lies a great advantage of this system, namely, the ease with which a telpher plant can be extended if a greater output be desired. To double the output subsequently, all that is necessary is to cut the line into twice as many sections, put in twice as many block switches, and run twice as many cars as before. The limit to the extension is given by the shortest possible distance allowable between two cars. Experience has shown that this distance is about 12 metres on an open track. At the charging stations or in a siding, 3 metres are ample: 12 metres are, however, necessary where there are points and crossings, to give time for these to work before the next car is ready to enter them. Otherwise a great deal of unnecessary stopping and starting would occur all along the line.

The block switches, which effect the blocking and releasing of the cars (fig. 1), are no different in principle from those to be found in every hotel bedroom, one at the door and one

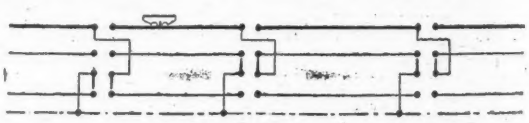


Fig. 1.

over the bed. If we switch on at the door, we can switch out at the bed, and *vice versa*. This is just what the car does. It switches off the section it has just left, and switches it on again when it reaches the next section. By means of this simple switching system it has been possible to solve the most complicated problems of interblocking at switches and crossings, of automatically turning the points, and so forth.

The principle underlying the block system in a siding is as follows (fig. 2):—

If the line *a* is cut out by a car turning switch A, it must

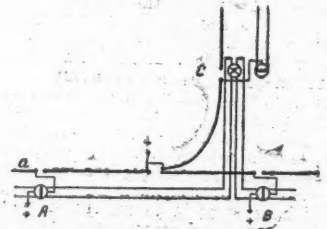


Fig. 2

be given current again when the car reaches switch B, or, if the points are set accordingly, when it reaches switch C. The supply of current to *a* must therefore be controlled from two places, B and C.

C is an ordinary reversing switch. Suppose B and A are in step: and supposing a current to pass from B to A *via* C, using the upper lead, then this current will be cut off on a car passing switch A, which throws the switch blades on to the lower lead. In order again to supply current to A, the switch blades of B may be thrown on to the lower lead by the car passing B, or the upper and lower leads may be crossed against each other by the car passing C. In that case the current will pass from the upper lead at B through the reversing switch into the lower lead at A, and into the line.

The switch gear is totally enclosed, and thus unaffected by weather conditions. The greatest advantage of this system, however, lies in its safety. Should a switch become defective by breakage or some such cause, the contacts can never jam in such a manner as to give current to a section that should be blocked. They can only fail to release a section which has already been blocked by the previous car, and thus cause a stoppage of cars all along the line, which will immediately be noticed.

At the bunkers and charging stations the line is divided into a number of short sections, so that a number of empty skips can wait for filling just outside the stations. Each car, as soon as it is charged, is sent on its way by giving current to the section on which it stands by means of a pull switch. As soon as it turns the block switch at the end of this short charging section, all the cars waiting outside the station move up by one section.

The most important part of the plant is the ropeway incline, and a very neat method of automatically coupling the cars to the running rope is the automatic gripping device invented by Adolf Bleichert. The principle underlying this invention is that of letting the weight of the car act directly on the grip of the rope. Fig. 3 shows the principle, omitting constructive details.

The gripping jaws are like the jaws of a nut-cracker. One arm of the nut-cracker goes to the traveller, and the other carries the load. The pressure on the rope is therefore directly

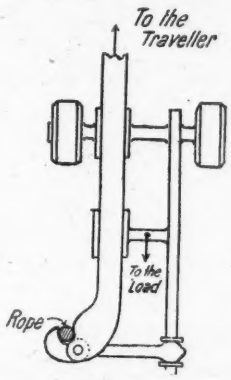


Fig. 3.

proportional to the weight of the skip. When the rope is to be released, the weight is taken up by a couple of rollers in connection with the one lever arm, and the jaws open and release the rope. With this system it is immaterial whether the rope used is thick or thin, and therefore the gripping power becomes no smaller when the rope is old and has decreased in diameter owing to stretching.

At the foot of the incline, where the telpher car is automatically attached to the rope, the suspension rail is bent slightly downwards, so that the car cannot fail to move forwards with the speed of the running rope at the point of coupling, which prevents a sudden load coming on to the rope. As soon as the latter is gripped, and the car starts on its way up the incline, there is no further need for electric power, and the line is interrupted until the top of the elevator is reached, where the cars are automatically uncoupled, and run on under current. It once happened that a car was admitted into the incline by a careless workman before the ropeway had been started up. Consequently the car was held back by the rope and left under current until the armature burnt out. In order to safeguard against such an occurrence again, the line is now interrupted before the point of coupling and the section at the beginning of the incline supplied with current over a special fuse, so that the motor cannot burn out.

Recently a further safety device has been added to each car, in order to prevent the burning out of an armature, which might occur from such causes as overloading the skip, or in the case of automatic discharge, allowing the pile to grow to such a height that the cars get stuck in it, whilst the motor is under current. An ordinary fuse is no good in this case, as it would have to be large enough to take the full starting current, which is about three times the normal current; but

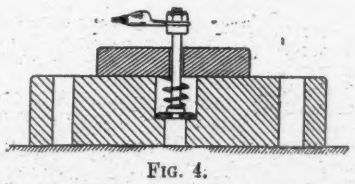


Fig. 4.

three times the normal current continuously would be sufficient to burn out the armature. A thermostatic time fuse is therefore used, the action of which depends on the heating of the motor casing. The principle is illustrated in fig. 4.

The current from the negative motor brush passes to earth over a fuse of some metal, which melts at 60° to 80° C. A good contact is ensured by a spring. If the temperature of the motor casing exceeds a given value, the fuse melts, and the plunger contact drops into a well, where it has no connection to earth, and the motor current is interrupted.

In the case of charging by telpher the ore is stored in bunkers. These are cross divided into a number of cells from which the ore may be drawn into telpher skips running on several lines underneath the bunker. If several different kinds of ore are smelted, as is usually the case, the different sorts are stored next to each other, each kind running across the bunker. Such an arrangement is convenient, as each class of ore is kept to its special portion of the bunker, and not scattered over it in various places, and charging the bunker by rail is thus facilitated.

At the entrance and exit of the bunkers the various telpher tracks join up by points to one suspension rail, which takes the charge to the "charge siding" (fig. 5). Each furnace has its particular siding where the charge is built up by admitting the correct number of skips filled with ore and flux, *a*, *b*, and *c*, for each furnace, until the charge is complete. This is done by one man, stationed in a signal and switch box at the

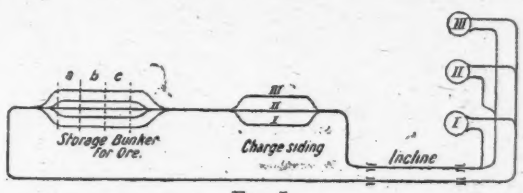


Fig. 5.

entrance to the siding. As soon as the charge for one furnace is complete, the whole train is sent up to the hopper at once. The cars automatically grip the rope on the incline, at a distance from each other regulated by the block switches. On arriving at the furnace mouth where they are needed, they range up in a siding one behind the other, from which position they can be brought forward separately by means of a pull switch, and emptied into the hopper at any desired point. From here the empty skips are sent back to the bunkers on the "down" track, thus completing the loop. It will be seen that one charge never interferes with the working of another, as the motion is continuously a forward one. It is obvious that an arrangement such as this allows of a very thorough supervision of the composition of the charge thrown into the furnace, as building-up the charge is in the hands of one responsible person, and does not depend in the least on the rest of the men.

Another method besides the ropeway for hoisting the telpher skip to the furnace mouth which has been found to be very successful where the height of the furnace is not very great is the spiral elevator. The principle of this is that of a spirally-bent suspension rail, up which the telpher cars are pushed by means of a vertical bar, which is made to revolve in the spiral and press against a roller at the rear end of the cars. The bar revolves continuously, and the cars are admitted at the correct moment for the bar to carry them to the top. This is done by interblocking in the following manner:—

The last block section is placed a little before the spiral, the line entering the spiral being always under current to ensure the car moving right forward into a position where it may be caught by the revolving bar.

In order to prevent a collision between the revolving bar and the telpher car entering the spiral, two separate blocking devices are arranged for the car and the mechanism of the spiral respectively. Considering the block system for the telpher first: the last block section is cut off from the supply on a car passing switch T. (fig. 6), and will only be signalled free again when the car has passed switch O that is at the foot of the incline up the spiral, when it will be carried away by the mechanism of the spiral, and make room for the next

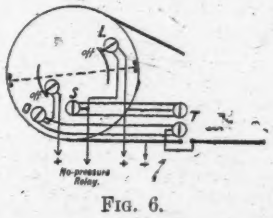


Fig. 6.

car. In order to prevent a car moving into the spiral just at the moment when the revolving bar might collide with it, the supply to switch T and the block section passes through a switch worked by the mechanism of the spiral, which cuts off the current when the bar sweeps through the dangerous zone. By this means the entrance for the cars is made safe, for a car cannot pass switch T unless the passage is free, and once it is on the live section behind T, it must travel forward to O, where it will be caught by the revolving bar. It might, how-

ever, happen that owing to some accident, say a fuse blowing, the car passes switch T, and then stops between T and O in the path of the revolving bar. In this case it becomes necessary to stop the spiral automatically to prevent a collision. The block system for this is as follows: The motor for driving the spiral is provided with a no-pressure cut-out, and the current for holding up the no-pressure relay is supplied from two independent sources, first over the two block switches T and S, and secondly over a switch L, operated by the spiral arrangement. This switch L is always switched in except when the bar passes through the dangerous zone. During this time the no-pressure relay must take its current from T over S. If, however, a car happens to be standing between T and S at this moment, that is, standing in a dangerous position, the two block switches T and S will be out of step and no current can flow. Consequently the no-pressure relay will drop out and the spiral mechanism stop, as soon as the bar comes into the dangerous zone.

The spiral for conveying the empty skips downwards needs a special arrangement for drawing the cars forward at the right moment, so that they may rest behind the revolving bar which guides them down. The live wire is interrupted about 1½ feet before the entrance to the spiral, so that the speed of the car will be greatly diminished in travelling over this short dead section against the brakes. At the end it is caught by a hook, which prevents it running freely down the spiral. The top of the revolving mechanism is provided with an outrigger of a peculiar curved shape, so constructed as to catch a projecting lug on the traveller, and draw the car forward as it revolves. The hook, which hitherto held the car back, is raised by a saddle-shaped angle iron engaging with a roller on the hook. As the car is guided into the spiral it slides into position behind the revolving bar, and is now ready to start on the descent. The curved outrigger is so constructed that the pressure on the car is always in the direction of motion of the latter, so that there is no tendency for the car to jump the rails. Moreover, the curve is extremely gentle at the first impact, so that the traveller is moved forward only a little for a big movement of the outrigger, and gradually speeded up on entering the spiral. By this means there is no jar on the mechanism, nor sudden load on the driving motor of the elevator when a car enters the spiral on the descent.

COAL-CUTTING MACHINERY AND THE OUTPUT OF COAL.

The total output of minerals from the mines in the United Kingdom for the year 1913 was 301,611,353 tons, of which 287,411,869 were coal; 2,585,763 fireclay; 7,709,624 ironstone, 3,280,143 oil-shale, and 623,954 sundry minerals. A further 18,604 tons of coal were obtained from open quarries, so that the total output of coal was 287,430,473 tons, which is an increase of 27,014,135 tons on the year 1912, and is the highest output ever recorded. The year 1912, however, is probably not a fair comparison, as the national strike took place that year when practically the whole of the mines were stopped for nearly six weeks. Compared, however, with the year 1911, there is an increase of 15,538,574 tons.

The total number of persons employed in the 3,289 coal mines was 1,127,890, being an increase of 38,800 over those employed during the previous year. Of these, 909,834 were males employed underground, while 211,483 males and 6,573 females were employed above ground.

Compared with the year 1873 it is interesting to note that the output of minerals under the Coal Mines Act is more than doubled, being in 1873, 143,041,246 tons, and 301,611,353 tons in 1913. It is, however, noteworthy that though mining conditions have undoubtedly improved, both on the surface and below ground, yet the output per underground worker per year is less by 40 to 50 tons per annum. For instance, the average number of men employed below ground during the years 1873 and 1882 (both inclusive) was 403,281, for an average output of 152,221,629 tons, giving an average output per worker of 377·4 tons, whereas for the year 1913 the average output per underground worker was only 331·5 tons. For the 10 years 1893 to 1902 the average was 366·7 tons, while for the year 1911 the average was 331·1 tons, and for 1912, the year of the strike, it was only 310·8 tons. No doubt one cause of the reduced output may be due to the mines being older, and to the better seams being exhausted, but the introduction of improved mining conditions and the use of coal-cutting machinery one would have thought would have counterbalanced the effect due to this cause, and one can only come to the conclusion that it is mainly due to the Socialistic teaching of the men's leaders and legislative interference in hours and wages. The output for the different districts is given in the following table :—

Quantity and Value of Coal Raised.

	Tons.	Value. £	Increase over 1912, tons.
No. 1 District—Scotland	42,456,516	20,514,873	+ 2,937,887
No. 2 ,, Northern Division	58,675,687	30,643,973	+ 5,266,438
No. 3 ,, Yorkshire	72,951,841	33,422,308	+ 8,069,904
No. 4A ,, Manchester	11,289,296	5,975,728	+ 873,122
No. 4A ,, Ireland	82,521*	50,654	— 7,786
No. 4B ,, Liverpool and North Wales...	16,841,549	8,355,251	+ 947,373
No. 5 ,, South Wales...	56,830,072	33,744,202	+ 6,713,808
No. 6 ,, Southern Division	28,284,387	12,824,158	+ 2,212,525
	287,411,869	£145,631,147	+27,013,271*

*This increase does not include the coal from quarries, but from mines only. The total increase, including that from quarries, was 27,014,135 tons.

The increase in the output of coal has led to a considerable increase in the use of coal-cutting machinery, the coalfield of Scotland again leading the way with an increase of no less than 105 machines, and an increase of 1,592,982 tons of mineral produced by their aid.

The following table shows the position of coal-cutting machinery in the various inspection districts :—

		Electricity.		Compressed air.	
District.	Type of machine.	No. of machines.	Tons of coal cut.	No. of machines.	Tons of coal cut.
Scotland.	Disk ...	484	5,646,675	133	1,440,741
	Bar ...	191	1,878,081	8	63,821
	Chain ...	16	88,157	—	—
	Percussive	2	1,415	33	83,610
	Rotary heading	7	—	2	1,074
		700	7,614,328	176	1,589,246
Northern Division.	Disk ...	56	649,202	68	581,835
	Bar ...	31	361,316	15	152,285
	Chain ...	44	288,278	9	45,297
	Percussive	3	1,628	436	1,458,183
	Rotary heading	—	—	3	707
		134	1,300,478	531	2,238,307
Yorkshire.	Disk ...	146	1,750,162	183	2,559,899
	Bar ...	83	1,028,943	54	657,912
	Chain ...	102	1,143,577	34	272,128
	Percussive	—	—	71	187,215
	Rotary heading	—	—	—	—
		331	3,922,682	342	3,677,154
Liverpool and North Wales.	Disk ...	5	59,500	75	798,351
	Bar ...	15	188,939	16	240,225
	Chain ...	3	37,158	1	3,599
	Percussive	—	—	66	195,190
	Rotary heading	—	—	—	—
		23	285,597	158	1,237,365
Manchester and Ireland.	Disk ...	3	22,361	46	317,483
	Bar ...	6	27,892	12	47,996
	Chain ...	4	58,090	3	17,728
	Percussive	—	—	135	152,779
		13	108,343	196	535,986
South Wales.	Disk ...	2	15,730	3	18,258
	Bar ...	31	200,336	54	351,718
	Chain ...	3	26,912	3	8,916
	Percussive	—	—	19	17,849
		36	242,978	79	396,741
Midland and Southern Division.	Disk ...	29	315,115	13	229,300
	Bar ...	20	131,244	6	88,855
	Chain ...	21	217,103	7	86,090
	Percussive	—	—	74	149,558
	Rotary heading	—	—	5	2,386
		70	663,462	105	556,189

The above tables give only the quantity of coal cut, but in addition the machines were employed in cutting other mineral such as ironstone, fireclay and oil-shale.

Thus, in Scotland, the electric machines are credited with 112,963 tons and the compressed-air machines with 18,915 tons. In the Northern Division 6,464 tons, in Yorkshire 8,694 tons, both by compressed-air machines; whilst in the Southern Division the electric machines obtained 59,481 tons, and compressed-air machines 33,925 tons of ironstone. Hence we have a total of 1,307 electric-driven machines responsible for 14,310,312 tons of minerals and 1,587 compressed-air machines with an output of 10,289,256 tons. The larger number of compressed-air machines with the smaller output is due to the great number of small percussive machines.

With regard to the extended use of electricity in mines, the following table gives the aggregate electrical horse-power used for different purposes :—

Inspection Division.	No. of mines.	Surface.						Underground.					Gross total.
		Winding.	Ventilation.	Haulage.	Coal washing and screening.	Miscellaneous.	Total.	Haulage.	Pumping.	Portable machinery.	Miscellaneous.	Total.	
No. 1. Scotland ...	319	2,208	4,607½	3,042½	6,611½	9,809	26,278½	26,533½	43,393¾	20,628	2,806	93,361¼	119,639¾
„ 2. Northern ...	272	7,327	15,046	10,470	11,635½	20,358½	64,837	34,510½	37,592¾	3,764¾	3,554	79,422	144,259
„ 3. Yorkshire ...	320	1,204	7,027	2,663	19,704½	25,356⅞	55,954⅜	27,055	13,691¾	8,131¼	2,367⅜	51,245⅜	107,200
„ 4A. Liverpool & N. Wales	62	95	1,130	405½	1,307½	1,557¾	4,495¾	6,486	4,997½	398	1,019	12,900½	17,396¼
„ 4B. Manchester & Ireland	73	110	979	293	1,311	2,695½	5,388½	3,446	3,706½	264	546	7,962½	13,350½
„ 5. South Wales	294	22,951½	17,529½	13,340½	8,390½	28,369½	90,581½	38,412	50,948¾	764	1,111¾	91,236½	181,817⅞
„ 6. Midland & Southern	132	150	777	1,213½	3,221	3,779	9,140½	15,484½	17,246	1,754	809½	35,294	44,434½

Then, again, with regard to electric safety lamps, it is interesting to note a distinct extension of their use, though there is very considerable room for improvement as the following figures will show. In Scotland out of a total of 37,991 safety lamps 1,160 are electric, in the Northern Division of 134,140 lamps 6,662 were electric; Yorkshire had 25,004 out of a total of 228,769; Liverpool 385 out of a total of 67,510; Manchester 1,216 out of a total of 47,370; South Wales 2,716 out of a total of 188,495, and the Midland and Southern Division 680 out of a total of 73,549. We believe a reversal of these figures would add very considerably to the safety of our mines.

WAR ITEMS.

Mr. Eck and the Union Electric.

The correspondence that has been proceeding in our "War Items" respecting Mr. Justus Eck's explanation of his own and his company's position has brought us further communications this week, but, as intimated in our last issue, we are unwilling to devote further space to personal attacks and rejoinders. In our judgment, they do not either appeal to the general interest or make for edification. It is unfortunate that in our issue of September 4th, what was no doubt a slip of the pen in a somewhat lengthy sentence in Mr. Eck's letter made it appear that the majority of his directors during the 14 years' existence of the company, and to-day, were British-born subjects. Another writer has since fallen into the error of describing Mr. Eck as a director of the Union Electric Co., Ltd., which the reference-books and the Somerset House Files show that he is not. Mr. Eck has then fallen into the error of attributing a letter written and signed by Mr. Sydney Evershed to the latter's firm, who, as a matter of fact, have nothing to do with the correspondence. Now, if we were to permit this sort of thing to continue, it would become extremely difficult for the plain man to disentangle the skein and discriminate between accuracy and inaccuracy, or to tell one false coin from another. As we have already stated, public sources of information relating to companies are available for anybody in search of it. We confess to feelings of regret at the absence of that readiness to make the *amende honorable* which one expects from gentlemen who fall into *lapsus linguæ* in debate or *lapsus calami* in Press controversy. As the correspondence has chiefly resulted from the aforesaid slip of the pen, we think that the matter may be considered closed.—Eds. E.R.

"Capturing" German Trade.—In the course of an article on the necessity for ascertaining, in respect to the hardware trade, what the public will accept in place of what they have been using, the *Ironmonger* urges manufacturers to appoint a small but responsible roving commission, whose members shall visit all the big towns and get the retailers to come to their headquarters in each place to express their views:—"Many would welcome such an opportunity, and would even bring with them samples. The opinions expressed should be taken down in shorthand, transcribed, and forwarded to the secretary of the associated makers. The reports would be analysed and the results, along with the samples, submitted to a general meeting of the makers concerned in the venture. The effect of such a scheme would be to obviate overlapping of effort; it would facilitate the distribution of production among the works, as obviously those present at the meeting would pick and choose what suited their plants, and it would have the advantage of eliminating patterns likely to prove unsaleable and profitless, and of checking the undue multiplication of patterns. There ought to be no wasted energy by duplicating designs if the scheme were properly worked. The growth of manufacturers' associations during recent years has made such proposals quite practical, and it only requires a little initiative in each to start such a scheme a-rolling in every trade the Germans have invaded."

Electrical Trade Outlook in South America.—In the course of a valuable series of articles on "British *versus* German Trade in Latin-America," a Special Commissioner who visited South America several years ago for the *Engineer*, writes in that journal's currrent issue as follows:—

"Owing to the immensely favourable river systems of South America, the three most important of which—the Orinoco, the Amazon, and La Plata—occupy the larges portion of the continent, the opportunities offered to pioneers of the electrical trade are especially valuable. Of these opportunities the Germans have availed themselves to the utmost, and so well and so carefully have they studied the markets that in practically every one of the 20 different Latin States of South and Central America can their electrical plant and apparatus be found installed and affording satisfaction. Apart from this portion of the world, quite one-half of the electrical appliances and accessories trade is in the hands of German firms, and a large percentage of these have their head-quarters or agencies in London. In Argentina manufacturers of electrical apparatus will find a continuous demand for storage batteries, and of these, up till now, the United Kingdom and Germany have possessed a practical monopoly. What is there to prevent us from enjoying the whole of it in future? With regard to insulators, of earthenware, china and porcelain, we also hold a good share of the market; but Germany and the United States have both run us fairly close. Wire and cable, amperemeters, voltmeters, electric light carbons, loom insulators, insulating tubes, commutators, fuses, dynamos, electric motors, vulcanised fibre, switches, arc lamps, electric meters, batteries, battery jars, portable lamps, rheostats, electric ventilators, bells, underground cable accessories, and telephone apparatus have all been supplied by the United Kingdom, Germany, and the United States, and, to a lesser degree, by France and Belgium. The whole market not alone in Argentina, but in Brazil and Chile, is a most valuable one, and should be seriously cultivated by British manufacturers of these specialities. . . . Hydro-electric projects are now in view in such countries as Mexico, Argentina, Paraguay, Costa Rica, Brazil, and others of the South and Central American States, which only await a change in the political condition of things to put them—at least in part—into execution. Many millions of pounds sterling are to be expended upon these projects; the combined electrical industry of no single country could effectively deal with the whole, or even with the greater number, of the different undertakings, but the race will go to the most enterprising among the contractors . . . the earliest in the field.

"At least three of the most important of the schemes referred to were already being negotiated for by German electrical firms, such as have already sent plant and machinery to practically every part of Brazil and Argentina, and whose plans for ousting all other competitors from the field were singularly complete. It is now almost impossible that the firms referred to can carry out their obligations; in one case, at any rate, the principal machinery is ready, but it has not been shipped. In view of the complete collapse of German shipping arrangements, and the impossibility of obtaining the assistance of any other transport, this machinery cannot be delivered. It has not been paid for, and the loss will fall entirely upon the shoulders of the contractors.

"Our only competitors in this valuable market are the Swiss, and, generally speaking, they operate through the medium of German houses having branches in South and Central America, and citizens of the United States. But, as has been indicated, the the amount of business pending is so large and so costly, that combination rather than competition should be the spirit in which

manufacturers of this country and the United States should approach the conduct of the enterprise.

". . . Manufacturers and contractors on this side that they will not find the Latin-American markets in the same placid and accessible condition as those to which they are ordinarily accustomed. Just as the European war and its disastrous consequences have disturbed and incommoded our own economic state, so have the Republics mentioned suffered, and are suffering. It is inevitable, even for some time to come after the war has been ended, and the 'reckoning' has been paid, that business should remain stagnant and monetary matters stringent. But that is no reason for abstaining from 'getting right there,' as our friends the Americans put it, now. If we await the turn of the tide, and hesitate to risk anything because the skies are dark and the situation uncertain, we cannot expect, and we should not deserve, to succeed when the clouds disperse and the sun of prosperity again shines out. Now is the time to lay our plans."

German Electrotechnical Works.—The *Ironmonger* publishes the following announcement which was issued by the Association of German Electrotechnical Works just before the turning of the tide in France and the rout of the Austrian armies:—"After our great successes in the various theatres of war, many municipal authorities will ask themselves whether the negotiations which had been broken off by the declaration of war, for the granting of concessions for electrical undertakings, or the formation of joint undertakings between local authorities and the Association, should not be resumed. It will certainly be to the interest of the communities to discontinue these negotiations. If Germany is successful in the war, quite different factors will have to be taken into account when electrical concessions are granted than existed before the war. The conditions of the money market will be considerably improved, and the boom in trade which may be expected will also have a material influence on the economic future of the existing electrical works. Public authorities will therefore be wise in maintaining for the present an attitude of reserve."

A Power Company and the Prince of Wales's Fund.—Below we print a copy of a letter recently addressed by the Cleveland and Durham Electric Power, Ltd., to the Mayor of Middlesbrough. It will be observed that the company is doubling the employés' contributions to the Prince of Wales's Fund, instead of giving a lump sum contribution. We understand that the scheme was warmly taken up by the employés, and that the average voluntary contribution per man per week is 10d.

"The Mayor of Middlesbrough,
"Town Hall, Middlesbrough.
"*Prince of Wales's Fund.*

"Dear Alderman Bruce,

"I have pleasure in sending you herewith, as a first donation to the Prince of Wales's Fund, a cheque for £56. I hope to send you a like amount each month during the war.

"This sum is made up by voluntary weekly contributions of the staff and employés of Cleveland and Durham Electric Power, Ltd., and its allied companies, to which the company is adding a like sum voted by the directors, who prefer to double the employés' contributions—in order to encourage them to give as much as possible—rather than vote a lump sum contribution. Although the employés are scattered over Durham County and the North Riding of Yorkshire, and in places so far apart as Consett, Bishop Auckland, Hartlepool, Thirsk and Malton, it was thought desirable that their contributions should go to headquarters, viz., Middlesbrough, and be sent in total to you.

"My directors, in addition to doubling the monthly contributions of the employés, have further decided as follows:—

"1. To pay married men on service full wages, less Government pay.

"2. To pay single men on service half wages, less Government pay.

"3. To give special consideration and aid to dependants on single men on service.

"4. To keep all situations open.

"There will therefore be no call on any public funds by the employés of the company.

"Up to date about 13 per cent. of the staff and employés are on active service.

"*For* Cleveland and Durham Electric Power, Ltd.,
(Signed) "Arnold B. Gridley, *Manager.*

"*September 21st*, 1914."

Mr. Seabrook's Brother Killed.—We are sure that large numbers of our readers will desire to express their sympathy with Mr. A. Hugh Seabrook, of Marylebone, on the death, which occurred on September 10th, while on duty in France, of his youngest brother, Lieut. J. H. Seabrook, aged 30, who, at the outbreak of the war volunteered as a dispatch rider. Lieut. John French Blake commanding the 5th Signal Troop, R.E, writing of the circumstances under which Lieut. Seabrook fell, says:—

Lieut. Seabrook was killed while carrying out his duty. He had done splendid work for us as a motor cyclist dispatch rider, and was immensely popular with all. . . . We were in touch with the Germans early in the morning, and moved to turn their flank. I sent Lieut. Seabrook to the headquarters of the 2nd Army with a message before this, and when he returned to the point of dispatch we had gone. He was told by another of my motor cyclists where we had gone, and which road to take, but he appears to have missed his way, taken a wrong road, and run straight into the enemy. The end must have come very quickly and painlessly, as he was shot in the head—two other bullets also found their mark.

Blackpool Illuminations.—The autumn season electrical illuminations of the Blackpool Corporation include a design representing the flags of the Allies, and at the foot appear the words, "A Call to Arms. Your King and Country Need You."

A Plea for the Single Man.—From what we can gather there is a disposition in certain quarters to treat the single man who throws up his position and enlists in the service of his country, as though he was merely doing as he should do, and was entitled to no consideration beyond a pat on the back. If that were so, then what should we have to say of the millions of young men of eligible age who are remaining at home with posts and salaries and wages secure in consequence? Either we must admire and treat with fairness and consideration the former, or have what amounts to contempt for the latter. We prefer the former of these courses, deeming the young man who has broken into his professional prospects as deserving of consideration wherever an employer is in a position to give it. Now if we think of this matter in relation to electricity supply, we find the argument strengthened. Not only are municipalities and electric supply authorities generally well able to carry such a burden as half salaries would impose, but we believe it is a fact that in a number of works the staff remaining at home are doing harder and longer service while their *confrères* are away, rendering it possible to avoid filling, even temporarily, all the places of those who have joined the Colours, and so keeping down salaries and wages account. In the case of married men it is the fact that there are dependents, whether wife or children, or both, which regulates the amount of the allowance, but there are hundreds and thousands of single men who have dependents upon them. Nobody has any right to probe into their private affairs—why should they be required to disclose all about the financial standing of their parents, grandparents, and other family or other connections when they elect to serve the country? To our way of thinking many a single man is deserving of far better treatment than he is receiving, whether he has or has not dependents, considering the sacrifice that he is making, and our view is that half wages to electricity supply men should be guaranteed, their places, of course, being kept open as far as possible. It would be interesting to know what our electricity supply works generally are doing in such cases, also what course is being pursued to get over the difficulties consequent upon the absence of employés.

British Aluminium Employes.—The British Aluminium Co., Ltd., report that up to the present 453 men—equivalent to 20 per cent. of the company's employés—have joined the forces. At the Kinlochleven, Larne and Milton Works and at the head office, the response has been both prompt and enthusiastic, some 40 per cent. of the total employés at Kinlochleven alone having volunteered, the number including practically all those who were eligible. In addition, about 200 of the men employed at the company's Milton (North Staffs.) rolling mills are being drilled nightly on the company's premises by their mates who happen to be old soldiers, and both here and at Larne—where the Ulster Volunteers are busy recruiting—more men are joining daily. The places of those who have been called up are being kept open, temporary provision being made in the meantime by drawing men from industries which are slack during the war, or from those who are otherwise unfit for service. Financial provision is being made for the staff in accordance with their responsibilities, and the families of all married employés serving with the Colours, or others dependent upon them, are being paid 10s. weekly, those residing on the company's premises doing so rent free for the present. Every effort is being made to keep the company's various plants fully occupied.

Trade Openings in Sweden.—The *Financier* suggests that British manufacturers and merchants wishing to obtain a market in Sweden should write to the Secretary, Swedish Chamber of Commerce in London (Inc.), 5, Lloyd's Avenue, E.C., for names of importers and advice on commercial conditions in Sweden, &c. The Chamber receives daily a large number of inquiries from Swedish importers who have hitherto purchased from Germany and Austria.

Birmingham Trade.—According to the *Financial Times*, Mr. H. W. Sambridge, President of the Birmingham Chamber of Commerce, states that for the moment the local trade is better than might have been expected after two months of strenuous warfare, and it is improving. Unemployment is a little in excess of the average. Financial difficulties are not so pronounced, but what is urgently needed is complete re-establishment of the foreign exchanges. As it is, the export trade is being crippled.

The Trade Opportunity in Italy.—The Milan correspondent of the *Times*, in referring to the German efforts to re-establish commercial relations with Italy, urges British exporters to realise that indignation against German methods gives every facility to British enterprise at the present moment. "It is absolutely necessary for firms to send representatives to the spot speaking either Italian or French, and ready with quotations in Italian currency and weights and measures calculated for delivery. Italy is prepared to do business. An influential person in the industrial life of Milan has expressed surprise that so far he has not seen any English traveller to make the most of a propitious moment. 'Why,' he said, 'if the positions were reversed, we should be crowded out in our towns by German travellers.'"

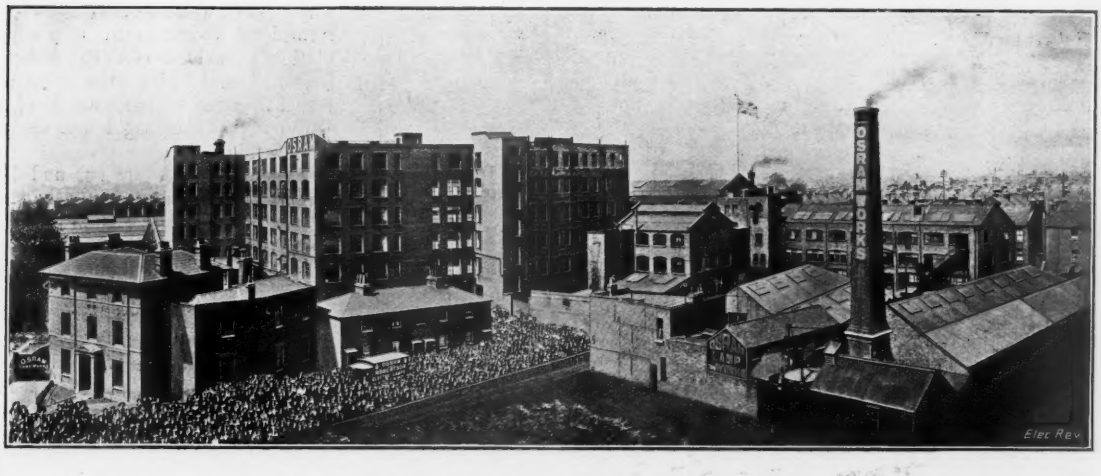
Board of Trade Assistance.—Among other pamphlets of the special series issued by the Board of Trade Commercial Intelligence Department is one giving particulars of the exports of rail locomotives for Germany and Austro-Hungary, together with selected notes regarding opportunities for this class of trade in different parts of the world. Another return similarly covers fire-proof bricks, retorts, crucibles, &c.; a third deals with building and furniture fittings, including locksmiths' wares.

Prisoners of War in Germany.—Very many people in this country have been placed under a debt of gratitude to Mr. J. A. F. Aspinall, general manager of the Lancashire and Yorkshire Railway, and a Liverpool gentleman who was detained in Germany with him, for furnishing to the Army Council the names of a number of British prisoners who are interned in Munsterlager, Hanover. Mr. Aspinall returned safely to England some days ago.

(*Continued on page* 467.)

THE OSRAM LAMP WORKS.

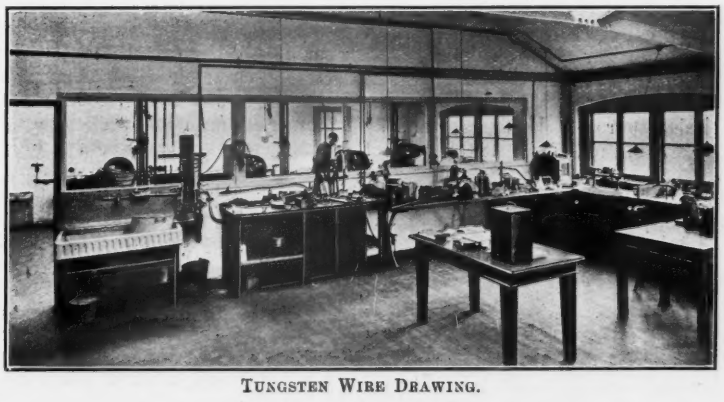
As mentioned briefly in our last issue, a Press inspection of the Osram Lamp Works was held last week by invitation of the General Electric Co., Ltd.



Exterior of the Osram Lamp Works, Hammersmith, W.

The Osram is the most familiar of the many named tungsten lamps used in this country, and the throwing open of every department of these large works to the Press and incidentally to the British public, was a step which we feel sure will meet with great appreciation at the present time.

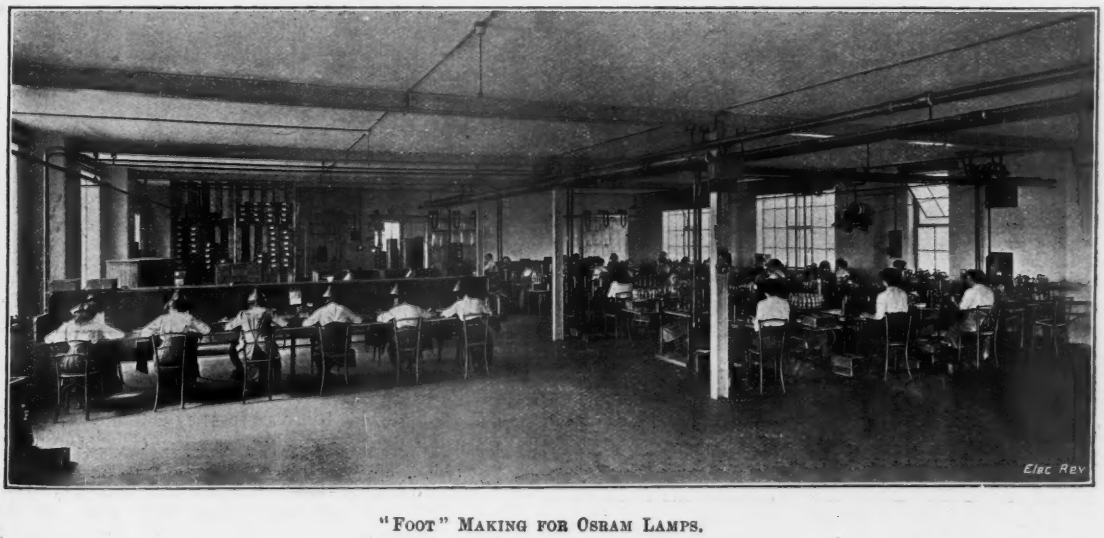
Adjoining the older Robertson (Carbon) Lamp Works of the same company at Brook Green, W., the Osram Works occupy a large modern six-storied building and give employment to some 1,500 hands; the latest plant is provided not only for the ordinary processes of lamp making, but also for the manufacture of the tungsten filaments from the powdered metallic oxide, and since the usual sources of supply of the latter material on the Continent are now unavailable, the company has taken the necessary steps and will in future manufacture the oxide from the tungsten ore.



Tungsten Wire Drawing.

All the glass bulbs, supports, &c., required in the making of both Osram and Robertson lamps are obtained from the company's glass works at Lemington-on-Tyne, which were described in our issue of September 18th last; and since the outbreak of war these works have given assistance to other lamp factories whose usual sources of supply are cut off.

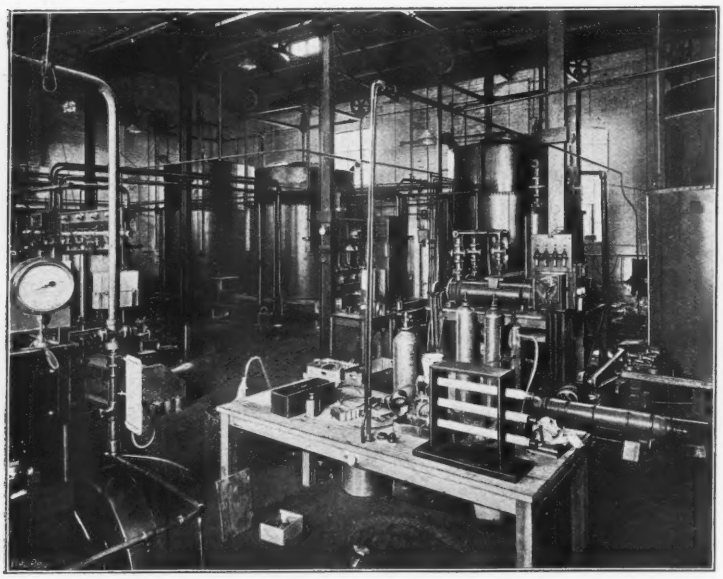
The first step in the manufacture of the tungsten for filament making is one of chemical reduction resulting in a



"Foot" Making for Osram Lamps.

fine metallic powder which is formed into thin rectangular bars by compression in a hydraulic press.

These bars, which are of a fragile character, requiring careful handling, are subjected to great heat in a hydrogen flame in a tubular furnace, and are subsequently treated in an electric furnace, being again heated in an atmosphere of hydrogen, from which they emerge considerably shrunk in size, but strong though somewhat brittle in character. The next process is that of swaging down to the requisite size for drawing, and the bars or rods treated in a hydrogen furnace are rapidly inserted into rotary hammers gradually reducing the bar into a long thin rod of ductile tungsten, of about $\frac{1}{3}$ mm. diameter.



The Hydrogen Plant, Osram Lamp Works.

In the following drawing processes these rods are passed through a succession of diamond dies, both the dies and wire being heated and lubricated with graphite during the operation; a very gradual reduction in size occurs at each die, until wire as small as ·001 mm. diameter is obtained, being wound on to bobbins for filament making.*

The general processes of lamp making are fairly well known to our readers; first the glass stem or spider is formed from tube and rod which are cut into the requisite lengths by machines, the tubes being subsequently automatically flanged at one end, while the rods are shaped to carry the filament supports.

The next step is the bringing together of the flange, centre rod and leading-in wires — the latter being formed of copper with a portion of platinum welded on to make the hermetic seal with the glass; the nickel filament supports are then fixed —the upper ones rigid and the lower ones flexible.

The upper ones are cut and looped by machine and inserted by hand, but, in the case of the lower ones, an ingenious machine has been introduced to replace hand work and insert a set of supports at one operation.

The next operation is the delicate one of winding the filament on the supports, which is performed by hand, the cage being then ready for insertion in the lamp bulb.

This is done after the bulb has been attached to the exhausting stem and the flange stem of the cage is then welded to the bulb.

The exhausting department at the Osram Works, of which we give a view, is a sight well worth seeing; although the methods adopted are the usual ones, the scale on which they are carried out is impressive.

Six or eight bulbs are exhausted at one time, sealed-off and then pass to the testing department, where samples from each batch of lamps are put through life tests extending from 600 to 2,000 hours, photometric tests of candle-power are made and the lamps suitably marked. Finally, the lamps are capped; the caps, made by the company, are cemented on and the leading-in wires soldered, special machinery being employed in this connection.

At every stage in its making the lamp is subjected to rigorous inspection in order to ensure a high standard of manufacture, this being a necessary and obvious precaution, when the final result depends on the efficient carrying out of so many successive processes.

Filament Winding Department, Osram Lamp Works.

The company has installed the necessary plant for manufacturing half-watt lamps, and some of the processes were shown to the visitors, but owing to the

* A good description of the manufacture of tungsten filament wire appeared in the Elec. Rev. of April 3rd last.

dis'ocation of labour caused by the war, it has been found necessary to concentrate for the time on ordinary tungsten lamp-making.

A feature of the Osram Works, which cannot but strike those acquainted with the conditions of labour prevailing in the average factory, is the exceptional provision made for the health and comfort of the worker; no better object lesson in this direction is needed than a visit to the works at Brook Green.

The Osram Lamp Works are the largest of their kind in this country, and are now capable of turning out upwards of 13 million lamps a year. In conclusion, our thanks are due to the General Electric Co. and to Mr. Christopher Wilson and his colleagues for the facilities which they kindly placed at our disposal on the occasion of our visit.

Exhausting Air from Lamp Bulbs.

THE CRYPTO ELECTRICAL CO.'S WORKS.

Some eleven years ago Messrs. J. G. & C. R. Shaw took over what was then quite a small electrical department of the Crypto Works Co., Ltd., of Clerkenwell Road, London, E.C., a firm principally engaged in the manufacture of gears for bicycles. Almost immediately Messrs. Shaw decided to manufacture electrical apparatus only, and took a small factory in Bermondsey, employing at the commencement about a dozen men. This was vacated for larger premises within two years, owing to the expansion of business, and, due to the same cause, the adjoining buildings on either side were subsequently absorbed.

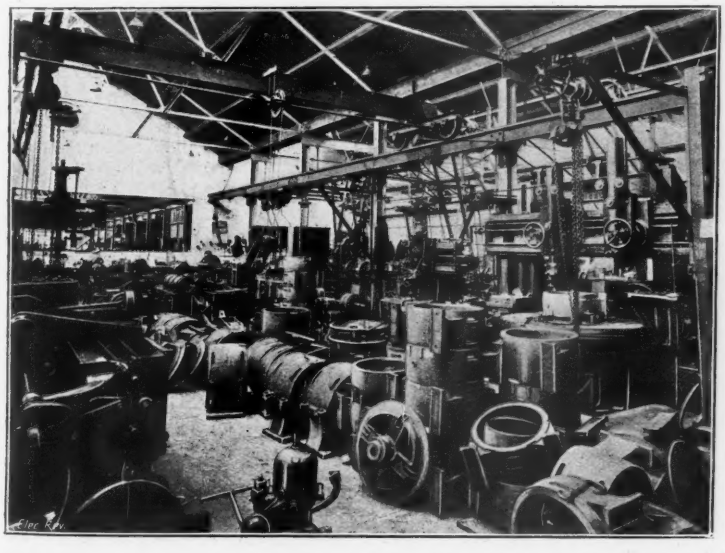
These additions, however, proved insufficient to meet the growing business of the company, and it was then decided to build a new factory, with which end in view freehold land was bought at Willesden and the requisite buildings put up.

It will be seen that the works at Acton Lane, Willesden, are practically new, in fact, the removal from the company's Bermondsey premises—which will in future be used only for repair work—is not yet completed. The new premises are practically all built on one floor, with the exception of the offices, and include machine, winding and erecting shops, a tool room, test rooms, and stores both for parts and finished machines.

The Crypto Co.'s Works, Willesden.

As many of our readers are aware, the firm have for some years been successfully identified with the small motor industry, and at the present time 72 different types of alternating and direct-current machines are being made, starting from $\frac{1}{16}$ B.H.P. and ranging up to 20 B.H.P., the largest standard size made by them. All the work is done to jig and productions are standardised as far as possible; machines are put through in batches, the finished parts and material required for erection being drawn from stores. The latter have been organised on modern lines, with labelled bins and racks containing all the numerous finished and semi-finished parts; each rack or bin contains a stock card giving exact particulars of its contents and furnishing an immediate check on stock generally. Adjoining these general stores is the main machine shop—a continuation of which forms an erecting shop and second machine shop, equipped with smaller tools.

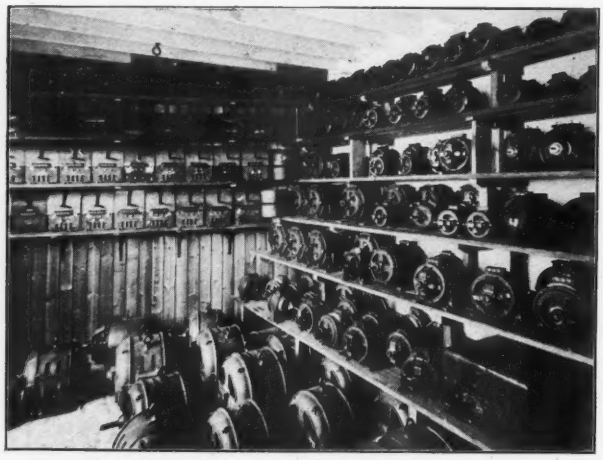
In addition to numerous lathes, drilling, planing, and milling machines, the equipment includes a large and three medium sized boring mills for machining shells, &c., a Churchill grinder for commutators and shafts, turret lathes for small repetition work, keyseaters, &c. For grinding



The Main Machine Shop, Crypto Electrical Works.

small tools each section of the works is provided with a grindstone, but the large and special tools are dealt with in the tool room, which is equipped specially for this class of work.

The firm's smaller standard machines are built up with cast-iron shells, and steel pole pieces welded in; in the larger sizes cast-steel shells are employed. Standard commutators are built by the gross, all insulations of the mica type being prepared in the works. Ball bearings are now a very usual requirement and are frequently fitted.



Stores of Finished Crypto Machines and Starters.

Special departments are devoted to direct and alternating-current winding and testing. In the former an equipment of coil winding and taping machines is provided, and it may be noted that all armature and field coils are subjected to two distinct impregnations and three separate bakings with a view to ensuring high insulating qualities.

All commutators are fitted to shafts before the armatures are wound, with a view to saving damage to the winding in handling, and stocks of wound armatures of all sizes are kept in order to facilitate the rapid completion of orders.

In all, about 14 different types of brush gear are made for the various machines, and special benches are set apart for this work, as also for the fitting and assembling of motor starters which the firm supplies for its motors.

The Light Machine and Assembling Shop, Crypto Works.

In the A.C. department a variety of single and polyphase motor and starter work is dealt with; recent improvements which have been effected in the methods of winding and construction of the spider enable the firm to turn out a remarkably cool-running machine—in fact, a 10-H.P. single-phase motor which we saw on test, showed a full-load efficiency of 88 per cent., power factor ·88, and a temperature rise of only 22° F. after four hours' running.

A special store-room is provided for alternating-current motors, ready for immediate dispatch, this supplementing a larger finished stores in which several hundred direct and alternating-current machines are kept.

In addition to the simpler types of machines which constitute the bulk of the Crypto Co.'s business, several special types of small motor-generators and converters have been developed for cinematograph work, charging accumulators, &c.; another machine which has been largely adopted for testing purposes is a variable frequency alternator—a single armature machine giving a high output for the size of frame employed.

In addition, we may mention the firm's variable speed interpole motor giving a speed variation of 3 to 1, the Crypto petrol-electric sets, polishing motors, auto-transformers and small switchgear; the company endeavours to maintain a high standard in its work, and, indeed, supplies machines to both the Admiralty and War Office. We understand that since the outbreak of the war the Crypto Co.'s stocks of machines have been heavily drawn on, and that, in view of the firm's organisation, present and future prospects are particularly bright.

In conclusion, we are indebted to Messrs. Shaw and to their works manager, Mr. J. Smith, for assistance in the preparation of this short article.

Brown Coal in Victoria.—Whilst reading his inaugural address to the Victorian Institute of Electrical Engineers on June 4th, the president, Prof. Henry Payne, dealt with the question of the local fuel supply. Pointing out that in Victoria the supply of black coal appeared to be limited to a few decades at the present output, he said that whilst further coal supplies might come to light, it behoved them not to overlook the immense stores of energy lying dormant in the brown coal deposits around Melbourne, bores having revealed beds of tremendous thickness at no very great depth and underlying an area of many hundred square miles. It would appear that the main reason that had hitherto prevented the utilisation of brown coal was that they had been hidebound in the production of energy through the medium of black coal, all their boilers being designed therefor. It was true that brown coal was of smaller calorific value than black coal, and that it contained a considerable percentage of moisture which seriously detracted from its heating efficiency when burnt in the ordinary way for steam generation, but the presence of even such large quantities as 30 per cent. or 40 per cent. of moisture might be advantageous in generating producer-gas, by which medium it was quite possible to deal effectively with the brown coal deposits in the generation of energy. There did not appear to be any fundamental reason why all the power required, not only for Melbourne's needs, but—if need be—for the whole of Victoria, could not be readily found. Such could be supplied from a central station on the site of one of these huge brown coal deposits, and the transmission of this energy to distributing stations presented no insuperable engineering difficulty. The problem of dealing with brown coal had been solved in Germany, where the deposits were being worked in many districts; the economic mining of Victoria's brown coal deposits should not be insuperable. These sources of energy were very valuable, pointing, as they did, to a continuance of cheap fuel supply for a considerable period of time.

WAR ITEMS.

(*Concluded from page* 462.)

Trading with the Enemy.—The British Engineers' Association has issued a report on this subject expressing dissatisfaction at the policy of the Government and giving particulars of a protest made by it to the Government. The printed document gives the Association's definition of an alien for the purposes of trading, and recommendations which the Council makes to its members. The Association has collected and filed particulars relating to the constitution of a considerable number of firms in this country who have interests in Germany and Austria, and it is open to investigate the constitutions of firms whose names are submitted by members.

An Inquiry Bureau.—The Employers' Parliamentary Council is stated by the *Times* to have decided to assist members of the Association under existing circumstances by the establishment of a temporary inquiry bureau, whereby members buying and selling goods could be placed in connection to their mutual advantage; arrangements in this connection were to be made whereby the scheme should be worked in co-operation with the one recently instituted by the Board of Trade.

Arc Lamp Carbons.—The Electrical Engineering and Equipment Co., Ltd., inform us that their works in Switzerland are working day and night, and they are fully capable of executing orders for any quantity of all kinds of arc lamp carbons as heretofore. The difficulty in procuring raw material has been overcome, and they are experiencing very little inconvenience as regards shipments.

The County Company's Men.—About 25 per cent. of the total staff of the County of London Electric Supply Co., Ltd., representing 75 per cent. of those eligible, have left for war service. The company have arranged to keep the whole of the men's places open for them and to continue pay, and special arrangements have also been made to assist the wives and dependents of all members of the staff on service.

Active Service Allowances.—The Anchor Cable Co., Ltd., Leigh, are giving £1 to every employé who enlists, and are looking after their dependents during their absence.

The Cleckheaton Electricity Committee has decided to make an allowance of 5s. per week to the wives of men in their employ who are on active service, and 2s. per week for each child under the age of 14 years, the vacated positions to be kept open for the men upon their return.

The Naval Disaster.—Mr. Samuel Hulme, a Naval Reservist who has been employed at the Bury electricity works, was one of those saved from H.M.S. *Hogue*, which was sunk by a German submarine. Mr. Tom Kay, son of Mr. J. Kay, Dundee Lane, Ramsbottom, near Bury, chief electrician on the *Hogue*, was also saved.

Power Station Sleepers.—The Commanding Officer of the Preston District has expressed his appreciation of the action of the Corporation Tramways Committee in allowing recruits to use the cars without charge, and in providing sleeping accommodation at the power station for a number of recruits.

BUSINESS NOTES.

Trade Announcements.—Messrs. J. W. Brooke and Co., Ltd., of Adrian Works, Lowestoft, have purchased the drawings, patterns, machining jigs and templates for the Hesse reversing gear, recently manufactured by Messrs. Hesse & Savory. They will immediately make and stock a series of these gears.

Messrs. Schaffer & Budenberg, Ltd., of Broadheath, near Manchester, are transferring their entire Manchester business to Broadheath, and all communications should be addressed to them there. At the new works they will have greatly increased facilities for the manufacture of their specialities.

Mr. F. Marchant, electrician, has commenced business at 63, Ravensbourne Road, Bromley (Kent).

Messrs. Haslam & Schontheil, Ltd., of Cardiff, announce that the title of the firm has been changed to Haslam & Stretton, Ltd., the alteration being necessitated by Mr. Theodore Schontheil, who is a British-born subject, having adopted the surname of Stretton. The business will be carried on entirely as heretofore.

The offices of the Lighting Press Syndicate have been transferred to 37 and 38, Strand, W.C. Mr. A. J. Greenly is now managing both editorial and business departments. His advertising business has also been transferred to the same address.

Messrs. Simplex Conduits, Ltd., announce that the telephone numbers of their Liverpool branch have been changed to "Royal 4726 and 4727."

Messrs. David Anderson & Co., Ltd., lighting engineers and contractors, of 18 and 20, Farringdon Road, E.C., who are about to open a new electrical department, invite manufacturers to send their latest catalogues.

Messrs. Laing, Wharton, Ltd., announce that their offices, showrooms and workshops, have been removed to Mildmay Park Works, Mildmay Avenue, London, N., where they are laying down additional plant and tools for making their various electrical lines.

Book Notices.—The Bonecourt system of surface combustion is described in a booklet recently issued by Messrs. Bonecourt Surface Combustion, Ltd. After a quantity of general technical data, and a report of a lecture by Prof. W. A. Bone, a detailed description of the principles and applications of the system is given, from which it appears that the Bonecourt methods are already coming into vogue in connection with a number of industrial processes, such as enamelling, forging and annealing furnaces, heating apparatus of various kinds, and the generation of steam. A battery of three boilers fired with ammonia-recovery producer-gas is in course of erection in this country, and the Bonecourt boiler is also being used for waste-heat recovery in connection with gas engines and steel furnaces, and for oil-firing, while the use of coal in these boilers is being experimented with. Tests on the boilers are included.

Every Briton's War Book is a booklet issued by the Motherland League (price 6d.) as an alphabetical store of general information on all points connected with the war; it is well calculated to serve this purpose, though, as a first edition and no doubt hastily prepared, it does not at present cover all the points on which one seeks enlightenment. For examples, the Declaration of London, and the words howitzer and mitrailleuse, are missing, and misprints such as Bransbuttel, Landstrum, are met with. It is stated, too, that Germany uses an electric searchlight which is strapped round a soldier's waist, and illuminates over 18 miles! Some maps are given, and the second part of the book is devoted to a survey of the military, naval and material resources of the European Powers. It is an extremely interesting production, and cheap at the price.

What Every Private Soldier Ought to Know is the name of another little war book; it is the work of Lieut.-Col. Sir Frederick Ponsonby, and is published by Polsue, Ltd., price 2d. Its purpose is indicated by its title, and is admirably fulfilled by its contents, which consist of useful hints for men on active service.

"Engineering Workshop Drawing." By H. J. Spooner. London: Longmans, Green & Co. Price 1s. 6d. net.

A "Key to the London Telephone Directory" has been issued by Messrs. Stone & Colquhoun, of 92, Victoria Street, Westminster, price 2s., which classifies subscribers' numbers in numerical order. The number and exchange only of a subscriber are often known, and in this case the key supplies the means for discovering his name.

Catalogues and Lists.—British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Supply list No. 102/5, of 14 pages, giving tabulated voltages, candle-powers, prices and other particulars relating to their British-made "Auriga" drawn wire lamps, half-watt lamps of standard, projector, sign, train lighting, steamship, and other types, including candle lamps, head lights, motor-car and motor-bus lamps, and hand lamps.

Mr. Harry J. Booker, 51, Tothill Street, Westminster, S.W.—Circular giving a specification and illustrations of British-made standard motors and dynamos.

Messrs. Crompton & Co., Ltd., Chelmsford.—Twenty-page list (C2) containing full descriptive information and a great deal of tabular data together with clearly shown prices, of continuous-current motors of the protected type for various voltages and ranging from 1·65 H.P. to 50 H.P. Dimensions are also stated.

Messrs. James Keith & Blackman Co., Ltd, 27, Farringdon Avenue, London, E.C.—Twenty-eight-page booklet, fully particularising the Keith centrifugal steel plate fans, belt and motor-driven.

Messrs. Belling & Co., Derby Road, Edmonton, London, N.—Thirty-two-page illustrated pamphlet containing descriptive information and prices of many useful and attractive designs of Belling electric fires for household service. A special pattern consists of a combined heater and afternoon tea-tray. A number of pages are also devoted to designs of fires for industrial purposes, for factory and ship service. A separate leaflet gives prices, &c., of boiling-rings, grillers and combined griller-oven; and an interesting 8-page publicity booklet contains notes and neat sketches illustrating the applications of the electric fires in the modern home.

Liquidations and Dissolutions.—Perth Electric Tramways, Ltd.—A meeting of creditors will be held at 30-31, St. Swithin's Lane, E.C., on October 26th, to hear an account of the winding up from the liquidators, Messrs. C. Wren & F. A. Holyfield.

Ch. Mellier & Co., decorators, upholsterers, electrical engineers, &c., Mellier House, Albemarle Street, W.—Messrs. Godfrey Durlacker and Edward Benjamin have dissolved partnership. Mr. Durlacker will attend to debts and continue the business under the same style, and at the same address.

Bennett & Whitehead, electrical engineers, Hartlepool and West Hartlepool.—Messrs. Robt. H. Bennett & Vernon M. Whitehead have dissolved partnership. Mr. Bennett will attend to debts.

Consolidated Diesel Engine Manufacturers, Ltd.—The first meeting of creditors is called for October 8th, at Bankruptcy Buildings, Carey Street, W.C. In the course of a lengthy summary of the company's affairs, Mr. H. Brougham, the Senior Official Receiver and Provisional Liquidator, after stating the history of the undertaking, says:—"The failure of the company is attributed by Foord (the secretary) to insufficiency of working capital, excessive expenditure and the locking up of the company's money through making advances to the old company. Ellis (a director) is of opinion that it has been brought about by (*a*) the old company failing to repay the company's loans; (*b*) increased cost of oil and consequent decrease of sales of engines, which, together

with the Balkan troubles, did not permit of Carels Frères making sufficient profit to pay the dividend expected ; (*c*) excess in the cost of building the works ; and (*d*) the inability of the company to raise money, as had been expected, on the shares in Carels Frères. On the application of the Official Receiver, Sir W. B. Peat was, on July 7th, 1914, appointed special manager of the company until the appointment of a liquidator. At the date of the making of the winding-up order the affairs of Carels Frères required immediate attention, inasmuch as it was reported that their bankers had given notice to close the account at the end of July, and that the enforcement of the notice and failure to find further capital would probably result in the liquidation of the firm. The special manager (by his partner) attended at Ghent, inquired into the position there, and had interviews with members of the Carels family with a view to preserving the interests of the company which had thus become threatened. The special manager subsequently reported that Carels Frères at the end of April, 1914, up to which date the accounts of the firm for the preceding 10½ months had been made up, disclosed a very heavy trading loss, and as their business mainly depended on orders received from the company, Carels Frères was in a threatened condition and the company's shareholding in jeopardy. From the special manager's report it would appear that, in addition to the bank claim amounting to about £45,000, there were liabilities on debenture loans (without security) by the Carels family of £100,000, and other loans made by the same persons to finance the firm amounting to about £65,000, and that there were no means of raising moneys upon the firm's assets by mortgage, as the consent of the debenture-holders would first be required before security could be given in front of their debentures. The report further shows that Messrs. Carels had, it seemed, for some time past been seeking for outside financial help, and they were, in the result, able to put a proposal before the special manager providing for sufficient capital to be brought in to provide an amount for working capital and discharge the loan liabilities, preferred shares being substituted therefor. It was further reported that the assistance would come from certain foreign banks of standing and a Belgian financial firm who were expectant of developing the business in a new direction. The matter being urgent by reason of the bank notice expiring at the end of July, the matter was made the subject of an application to the Court, and the report came before the judge on July 28th for consideration on an application by the Official Receiver for leave to enter into negotiations with the Carels family for the reconstruction of Carels Frères in accordance with the foregoing proposals. The judge made the order as asked, and in pursuance of its authority the special manager pursued the negotiations with the persons concerned in Belgium, but they have of necessity been broken off in consequence of the war. It is impossible in the condition of affairs on the Continent to form any estimate of the future, but advices have been received that the Messrs. Carels are striving to preserve their assets so far as the distressing state of matters in their country will permit. The liabilities to creditors unsecured include £9,961, the balance due to Carels Frères, £1,293 directors' and managing committees' fees, £3,866 due to the consulting engineers, £430 solicitor's charges, and £214 accountants' charges. The balance is in respect of goods supplied, work done and usual trade expenses. The creditors fully secured hold (*a*) mortgage on the company's land, buildings and fixed plant at Ipswich, estimated to realise £110,000, against loans and interest amounting to £28,650 ; and (*b*) a charge on the office furniture in London, estimated to realise £300, against judgment debt and costs amounting to £208. This charge is under an order of Court directing the withdrawal of an execution levied at the company's offices on the June 18th, 1914, the day after the date of the presentation of the petition. The other liabilities include, possible claims amounting to £1,317 in respect of uncompleted contracts for the supply to the company of materials and the execution of work in connection with the erection of the works at Ipswich ; £2,954 balance of the cost of the railway siding at Ipswich, which, previously payable by annual rent, falls due on the liquidation of the company ; and £4,000, the estimated amount of claims for damages for breach of agreements with employés. The sum of £100 is also included as a nominal amount of liability in respect of two uncompleted contracts for the supply of iron ore to the company and in respect of a possible claim by the Ipswich Corporation under an option agreement with the company for the purchase of further land. The amounts which the land, buildings and fixed plant (charged to fully-secured creditors) and stock-in-trade, &c., are estimated to realise are based on the assumption that they will be sold collectively. The investments in shares include the company's share interest in the old company, not estimated to realise anything ; and in Carels Frères, estimated to realise £143,244, which estimate is based on a valuation made by Messrs. Wheatley Kirk, Price and Co., of that company's business in March last, together with a report by Messrs. Josolyn Miles & Co. The book debts include the sum of £69,120 owing by the Diesel Engine Co., Ltd., which is estimated to realise only £25,000. The special manager reports that no practicable steps to dispose of the Ipswich works can, in view of the war, be taken, but meanwhile they have been temporarily let on weekly terms to the military authorities for the accommodation of troops."

The Leskole Co., Ltd.—This company is winding up voluntarily, with Mr. A. H. Crowe, of 31, Great James Street, W.C., as liquidator. A meeting of creditors is called for October 6th.

Deed of Assignment.—George Braulik, electrical engineer, 8, Lambeth Hill and Maiden Lane, E.C.—Particulars of claims must be sent by October 10th, to the Trustee, Mr. G. E. Corfield, Balfour House, Finsbury Pavement, E.C.

Palmer's Shipbuilding Electrification.—At the annual meeting of Palmer's Shipbuilding and Iron Co., Ltd., at Newcastle-on-Tyne, on September 26th, Mr. G. Mure Ritchie, the chairman, in moving the adoption of the annual report, stated that the directors had realised the imperative necessity of bringing the steel and iron departments into line with modern requirements and conditions. They had formulated a scheme, and had already submitted it to the debenture-holders. The scheme provided for the installation of gas-cleaning plant, modern gas engines, gas producers, and other appliances for utilising profitably the gas which now escaped from the blast furnaces. It included a complete electrification scheme which would embody the provision of gas-driven alternators capable of supplying the needs of the company's shipyard, engine works, blast furnaces and steel works. When this plant was installed it would use large volumes of gas which now went entirely to waste. The total cost was estimated at about £250,000.

LIGHTING and POWER NOTES.

Aberdeen.—Street Lighting.—The Lighting Sub-Committee has decided at a special meeting that during the war all arc lamps shall be replaced with incandescent lamps, and that the number of lamps lit shall be materially reduced.

Arbroath.—Rating Appeal.—The Arbroath E.L. and Power Co. last week appealed against the valuation of the electricity works. The assessor's valuation was £1,215, the Parish Council asked the Court to fix the amount at £1,470, and the company asked that it be reduced to £500. The Court finally fixed the amount at £1,100. Mr. Collins, the company's representative, stated that the matter would be carried to the High Court.

Aylesbury.—Proposed Loan.—The U.D.C., not being able to obtain a loan on reasonable terms for the E.L. scheme, has resolved to secure an advance of £21,233 for one year from Lloyds' Bank at 5½ per cent. interest, subject to the Council being able to take up such sums as it may from time to time require.

Bacup.—Street Lighting.—The lighting of the two main thoroughfares, Newchurch Road and Rochdale Road, has been converted from gas to electricity, some 200 50 and 100-c.p. lamps being employed. The alteration is so satisfactory that further extensions are contemplated.

Ballyconnell.—The power house of the Ballyconnell E.L. and Power Co. is now complete. The machinery is being erected, and it is expected to be able to supply energy early in October.

Bath.—Year's Working.—The annual report of the year's working of the electricity department shows a deficit of £1,981, as compared with £1,445 in the previous year. The total revenue was £24,039 ; total working expenses £13,098, against £11,846 ; and gross profit £10,941, or £661 in excess of the previous year.

Belfast.—New Power Station.—After considerable discussion, the City Council has referred back to the Committee the recommendation of the latter, that the reports of Sir John Snell and Mr. Pratten, regarding the building of a new power station, be adopted.

Sir John Snell's report points out the imperative necessity of providing further plant to meet the load of 1915-16, and advises the adoption of the three-phase H.T. system for all future plant and transmission. He advises the Corporation on no account to remodel or permanently extend the present station, and suggests the purchase of a 3,000-kw. turbine plant, and a second 1,000-kw. rotary converter, without delay.

The estimated cost of this work, which would be completed by next autumn, is about £49,000. Further sections of the report go to show that the maintenance of the plant, the organisation of the staff, and the business side of the department are in a satisfactory condition.

Mr. Pratten's report is on very similar lines ; he considers that there are two and a-half years in which to establish a new works, and suggests certain additions to the present works in the meantime.

Blackburn.—Works Extension.—The Electricity Committee has just secured 60 acres of land at Whitebirk, between the railway and the canal, for extension purposes.

Messrs. Henry Livesey, Ltd., Greenbank Bobbin Works, were summoned last week for allowing black smoke to issue from their works chimney, and a representative of the firm stated that there would be no repetition, as they were going to electrify their plant.

Blackrock.—Overhead Wires.—The U.D.C. is applying to the B. of T. for permission to use overhead wires for the purpose of electricity supply throughout the district, with a few exceptions.

Bradford.—Workhouse Lighting.—The North Bierley B. of G. has obtained the sanction of the L.G.B. to an expenditure of £1,260 on a scheme for electric lighting at the workhouse.

Brentford.—Infirmary Lighting.—The Engineering and Works Committee of the Guardians has considered a specification from Mr. P. E. Ryecroft with reference to the experimental lighting of part of the infirmary with electricity.

Brymbo.—L.G.B. Inquiry.—An inquiry was held last week into the applicaton of the P.C. for a loan of £300 for electricity purposes, viz., street lighting. There was no opposition.

Cleckheaton.—The U.D.C. Electricity Committee has granted the request of the Spenborough Citizen Volunteers for the installation of electric light in the Whitcliffe Mount School drill field, in order that outdoor drilling might be continued in the evenings.

Clones.—E.L. Scheme.—The U.D.C. has approved of the agreement with the E.L. Co. for public lighting at 5d. per unit, also for the supply of power for the new sewage lift at 4d. per unit, with £5 per annum for supervision.

The B. of G. has decided that the installation of the electric light at the workhouse shall be proceeded with at once.

Continental Notes.—Norway.—The municipal authorities of the parish of Time, in the neighbourhood of Stavanger, have decided to buy the Folland Waterfall with the view of harnessing it and of erecting an electrical works. A loan of £14,000 is going to be taken up for this purpose.

Dolgelly.—Workhouse Plant.—The L.G.B. has sanctioned the scheme for installing certain electric plant at the workhouse, at a cost of £153.

Eastleigh and Bishopstoke.—E.L. Scheme.—The U.D.C. has decided to obtain a report from Dr. J. A. Purves, of Exeter, at a cost of 10 guineas, on the question of lighting the district by electricity.

Fleetwood.—Street Lighting.—A report as to the cost of improving the lighting of Lord Street is to be prepared by the Electricity Sub-Committee.

Greetland.—E.L. Scheme.—It is hoped to begin the electric lighting of the Upper Greetland township early in November.

Heywood.— Year's Working.— According to the borough treasurer's statement, there was a loss of £4,611 on the working of the electricity undertaking for the year ending March last; on the tramways a profit of £85 was realised.

Holmfirth.—New Power Station.—The B. of T. has sanctioned the Council's application for powers to construct a generating station, but the consent of the Board has not yet been obtained as to the method of supplying current.

India.—The question of electric lighting in the city of Agra and civil lines has been under consideration by the municipality, with the result that Messrs. Martin & Co., of Calcutta, agents for Messrs. Crompton & Co., are to carry out the scheme, work on which was to commence immediately.

Isle of Man.—New Generating Station.—Application has been made to the House of Keys for authority to erect an electrical generating station at Glen Auldyn in connection with projected chemical works. It is proposed to utilise the river there for power purposes.

London.—Stepney.—The Electricity Committee, owing to shortage of carbons, is reducing the number of arc lamps in use and replacing some of them with half-watt lamps.

It is proposed to give a limited bulk supply of 600 or 700 kw. during peak load hours and 1,500 kw. at other times to Shoreditch, arrangements to be made with Poplar to give Stepney a stand-by supply during the winter. The price to Shoreditch may be slightly increased owing to the necessity of running the older Stepney plant.

Kensington.—Street Lighting.—The B.C.'s experiment with half-watt lamps proving a success, the engineer has drawn up a scheme, with specially-designed lanterns necessary to supersede all the arc and certain other electric lamps used for street lighting in the borough. The total cost will be about £395. Owing to the inadequate supplies of carbons for street lighting, the Council is being recommended to approve the engineer's scheme.

Poplar.—Arrangements have been made by the Electricity Committee to give a stand-by supply of 2,000 kw. to Stepney. In view of the increased cost of carbons for arc lamps, the electrical engineer has expedited the change over from arc to incandescent street lamps on the Isle-of-Dogs.

L.C.C.—A conference of representatives of Borough Councils owning electricity works was to be held to-day to discuss the question of London's electricity supply in view of the promotion of legislation on the subject in 1915. The L.C.C. and representatives of the City Council, and the Lambeth and Camberwell B.C.s are to discuss the same matter on October 7th.

The City Council announces that the new scheme of lighting in the City streets is practically complete.

Mexborough.—Plant Extensions.—The extensions at the electricity works have just been completed, the additions comprising a boiler house, engine house, pump house, stores and offices. The new plant installed comprises a 750-h.p. Howden turbine, running at 3,000 r.p.m., and coupled to a 500-kw. Siemens generator. In the basement there is a surface condensing plant. Sufficient room has been allowed in the new buildings to admit of additional plant being installed if required in the future. The capital value of the extensions is £11,000, and the total capital cost of the electricity undertaking now stands at £35,000.

Montgomery.—E.L. Scheme.—The T.C. has deferred for 12 months consideration of the proposed electric lighting scheme.

Morecambe.—Promenade Lighting and the War.—Owing to the increased cost of carbons the Electric Light Committee has asked the Finance Committee to contribute £100 to meet the increased expenditure, but this has been refused. The Council has decided, in accordance with the suggestion of the Admiralty, that only one-half of the promenade arc lamps shall be lighted in future, and that the remainder shall be extinguished at 11 p.m.

Oakworth.—Proposed E.L.—The District Council has decided to grant an interview to the Yorks. Electric Power Co. to discuss the proposals in regard to the supply of electricity for power and lighting purposes.

Oldham.—The Electricity Committee has decided to receive a deputation from the Lees and Springhead District Councils, who have asked the Corporation to consider the supply of electricity in their districts.

Portishead.—New Power Station.—The Clevedon, Portishead and District Electric Supply Co., Ltd., has applied to the B. of T. for sanction to construct a generating station at Long Ashton in connection with the Portishead electric light scheme, and to the use of overhead lines for the transmission of current at a pressure of 550 volts to the South Liberty Colliery, Bishopsworth.

South Africa.—A Government inquiry has been held into the application of the Victoria Falls Power Co. for certain amendments of details of power. The application was that there should be no power at Driehoek, that the Simmer Pan allocation of 42,000 kw. should remain as before, and that the Brakpan figure should be increased to 45,000 kw.

Southampton.—A special meeting of the Council is to consider the report of Sir John Snell and Mr. E. Edmonds, the consulting experts, upon the Corporation electricity undertaking. The cost of the report, including fees, expenses and printing, was £594.

Southport.—Electrical Exhibition.—An Electrical Exhibition is being held by the Corporation, which has arranged with the local electrical contractors to undertake installations at 10s. per lamp, either on the deferred payment system (20 quarterly payments) or by cash payment, with a special discount of 10 per cent.

Stoke-on-Trent.—Loan Sanction.—The L.G.B. has sanctioned an expenditure by the B. of G. of £220 for an installation of telephones and electric bells.

Annual Report.—There was a loss on the past year's working of the combined electricity works of the borough of £6,162. The total revenue was £52,560. The net loss was £5,139, to which £1,023 was added on account of capital expenditure paid out of revenue. Extraordinary repairs to plant, increase in rate assessment, and the higher cost of fuel have been responsible for the loss.

Swinton and Pendlebury.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,571 for electric lighting of public streets.

Thorne (near Doncaster).—Prov. Order.—The R.D.C. has decided to support the Yorkshire Electric Power Co.'s Bill.

Todmorden.—Year's Working.—The borough treasurer's statement shows a loss of £1,144 on the working of the electricity undertaking for the last financial year.

Troon.—E.L. Scheme.—The T.C. has been informed that the promoters of the electric lighting scheme hoped to be in a position to supply electricity in the district early in November.

Walsall.—New Loan.—The T.C. has postponed the application to the L.G.B. for sanction for a loan of £23,595 for extensions to the electrical undertaking.

West Ham.—The borough electrical engineer has been asked to draw up a scheme for installing electric light at the proposed sanatorium at Langdon Hills.

Whitworth (Lancs.).—The L.G.B. has intimated to the D.C. that a loan for the electricity sub-station scheme cannot be sanctioned until plans, particulars and amended estimates of the cost have been submitted, and these are now being prepared.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The T.C., at its next meeting, is to consider the proposed acquisition by the city of the Aberdeen Suburban Tramway Co.'s undertaking.

Blackpool.—P.A.Y.E. Cars.—The Tramways Committee has decided to introduce the "pay-as-you-enter" system for top-deck passengers.

Coventry.—The Corporation is recommended to obtain powers in connection with the Bill about to be promoted in Parliament, to construct double lines of tramways along the proposed new streets from Broadgate to Hales Street, and from Burges to Fleet Street.

Croydon.—Recruiting Car.—We have received from Mr. T. B. Goodyer, the Corporation tramways manager, a view showing how a rail watering car on his system has been adapted with a view to helping forward local recruiting. The car is covered with recruiting notices, and at night rendered attractive with some 150 32-c.p. lamps.

Golcar.—The U.D.C. has decided to ask the Huddersfield Corporation on what terms it would be prepared to take the tramways to Golcar.

Halifax.—Annual Report.—The accounts of the Corporation tramways department for the past year show a total revenue of £109,650, and working expenses amounting to £73,272, leaving a gross profit of £36,377. The net profit was £13,642. The motor-omnibus account shows a deficiency of £172 upon the year's working, excluding any charges for sinking fund or depreciation. There was, however, a balance of £480 on the tire account, leaving a credit balance of £308.

Japan.—The growth of electric railway systems continues (says a Consular report from Osaka). There are now within a radius of 50 miles of Osaka close on 250 miles of double track in operation and 80 miles more under construction or proposed in the near future. Several inclined cable tramways are on the tapis. The growth of light railways has been slower, the mileage of single track being under 50 miles. Another 50 miles are under construction. Numerous plans are projected, but hitherto have been held up by the difficulty of finding capital.—*Financier.*

London.—Bethnal Green.—The L.C.C. is about to undertake the reconstruction of the tramways in Grove Road.

Stepney.—The B.C. is recommended to oppose the proposal to reconstruct the track work of the old horse tramway in Burdett and Grove Road, as there is reason to apprehend that the L.C.C. has in view the installation of the overhead system of traction, and the L.C.C. is to be informed that the B.C. is of opinion that the reconstruction should be such as to make it available for the adoption of the underground conduit system.

The Metropolitan Electric Tramways Co. has abandoned the proposed railless traction system from Tottenham to Walthamstow.

Newcastle.—The Tramways Committee has decided to seek Parliamentary powers to run through traffic between Newcastle and Gateshead across the high-level bridge.

Southampton.—The B. of T. has consented to the proposal of the Council to lay a double line of tramway in lieu of the existing single line in Bridge Street. The tramrails for a considerable distance towards Bitterne will shortly have to be relaid.

Stirling.—The T.C. has resolved not to proceed further with the negotiations regarding the proposed electrification of the tramway system and its extension to Bannockburn.

Tramway Receipts and War.—The official returns of 60 of the principal tramway undertakings of the United Kingdom for the week ended September 19th show total receipts of £226,838, or £7,747 less than in the corresponding week of last year.—*Standard.*

U.S.A.—Electric Vehicle.—The report of the Electrical Bureau of the City of Philadelphia, states that the time required in repairing troubles on the underground system has been very much reduced by the use of an electric truck, the number of hours in which the underground circuits were out of service having been cut down in 1913 about 40 per cent. as compared with 1912. The cost of operation in 1913 was a little less than for 1912, even with the greater amount of work. The forces employed were 20 as compared with 21 in 1912.

Wallasey.—Annual Report.—The accounts of the Corporation tramways department for the year ended March 31st show receipts £63,150, compared with £57,458 during the previous year. The passengers carried numbered 13,105,204, an increase of over a quarter of a million. Out of the profits £7,750 has been credited to the district fund in aid of the rates.

TELEGRAPH and TELEPHONE NOTES.

Cable Repaired.—The Direct Spanish Telegraph Co.'s cable between Falmouth and Bilbao, which had been interrupted, has been restored.

Cable Tariffs.—The deferred-rate system, which had been suspended by the Eastern cable companies, was resumed on October 1st.

Since our leading pages went to press, the Postmaster-General has announced that in future, all letters and figures in the address, text, and signature of telegrams for places served by the Eastern companies, will be counted together, each figure being reckoned as two letters, and the total divided by ten will be taken as the number of chargeable words, any surplus group of less than ten letters being charged as one word.

Cable Cut.—Cable communication between Sweden and Germany was interrupted on September 30th.

Corea.—There has been a marked development in the telephone system in Corea during the past few years, all the large cities and towns being now provided with exchanges. According to a recently-issued official report there are at present in Corea 45 telephone exchanges, including 21 special exchange offices, the total number of subscribers being 9,469. The aggregate length of the telephone wires in use is stated to be 12,260 miles.

Russia.—In a recently issued report on Russia, one of our Consuls states that some 20 radio-telegraph stations have been erected by the Chief Department of Posts and Telegraphs at various places on the Russian sea coasts. They are all equipped with the newest Marconi and Telefunken appliances, and are of three types:—(1) For roadsteads, of 0·5 kw.; (2) shore, for communicating with shipping, 1 kw.; and (3) high-power stations from 1 kw. upwards. The majority of the stations are of the second type, with waves of 300 and 600 m. and a working radius of 300 km. Most Russian stations can also send out 420-m. waves.

United States.—A special licence has been issued permitting the wireless station at Sayville, Long Island, to operate for regular commercial communication with Germany for a period until January 1st, 1915. This, says Reuter, is the only U.S.A. wireless station capable of direct connection with Germany.

Wireless in Warfare.—It is suggested that the German cruiser *Emden*, which has been so successful in capturing British ships in the Bay of Bengal, has been receiving information regarding the movements of shipping from the Telefunken stations in the Dutch East Indies; these are, of course, on neutral territory, but are probably worked by German officials.

Wreck of the "Buccaneer."—The crew of the cable steamer *Buccaneer*, which was lost while on a voyage from Mauritius to Tamatave in the Indian Ocean, reached Plymouth last week. There were 61 on board the cable ship when she ran ashore and became a total wreck. All were saved, although one boat capsized, the occupants having a narrow escape.—*Financial Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—November 25th. Victorian Railways. 25 battery signal machines for operating signals. Contract 27,479. Contractors' Room, Railway Offices, Spencer Street.

Adelaide.—November 11th. Portable desiccating plant, petrol motor driven, for Postmaster-General. See "Official Notices" to-day.

Perth.—November 18th. 249 accumulators and power board, for Postmaster-General. See "Official Notices" to-day.

Brisbane.—November 4th. Paper-insulated lead-covered cable; insulators; ironwork, &c.; cast-iron pipes; iron or steel poles and fittings; galvanised-iron wire; and covered wire, for Postmaster-General. See "Official Notices" to-day.

December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" September 25th.

Colwyn Bay.—October 20th. Turbo-alternators and condensing plant; boilers, stokers, pumps, &c; switchgear; cooling tower; crane; power station cabling and wiring; cables; rotaries and transformers, for the U.D.C. See "Official Notices" Sept. 25th.

Heywood.—October 17th. Corporation. Converting plant, A.C. and D.C. switchgear and cables, battery booster, E.H.T. overhead line, E.H.T. switchgear for sub-station. See "Official Notices" September 25th.

Hornsey.—October 9th. Two rotary or motor converter sets, &c., for the T.C. See "Official Notices" September 18th.

Leicester.—October 17th. Corporation. Steel plate, girders, steel troughing, &c., for the Tramways and Electricity Committee. Specifications from the Borough Engineer.

Littleborough.—October 12th. U.D.C. (1) Removal of transformer kiosk and gear and connection of mains to new sub-station; provision of additional cables, road work, &c. (2) Transformers, equipment and switchgear, for new sub-station. See "Official Notices" September 25th.

Manchester.—October 6th. Supply of a car-wheel tire boring mill. Specifications, Mr. J. M. McElroy, General Manager.

October 6th.—The Tramways Committee is inviting tenders for scrap materials, comprising miscellaneous copper, gun-metal and brass, &c.

South Africa.—Johannesburg.—October 9th. Ten single-truck double-decked electric tramcars, for Municipal Council. Specifications, &c., may be seen at Commercial Intelligence Branch of Board of Trade.

Stockport.—October 4th. B. of G. Tenders for electric lamps of British manufacture by a British firm. Forms from Union Offices, Shaw Heath, Stockport.

Swansea.—October 5th. Corporation. Lighting installation at Police Station. See "Official Notices" September 25th.

Taunton.—Corporation. October 2nd. 1,500 to 2,000 tons of coal for use on chain-grate stoker, for the Electricity Committee. Particulars from Mr. A. J. Howard, Borough Electrical Engineer, St. James Street.

Warrington.—October 13th. Sub-station ironclad switchgear for Tramways Committee. See "Official Notices" to-day.

CLOSED.

Australia.—The following tenders have been accepted:—

Commonwealth P.M.G.'s Department:—

Two generating sets for radio-telegraph station, £608.—Shaw Wireless, Ltd.

Postmaster-General's Department, Sydney:—

Fifty-five miles twisted pair wire, £264: 42 miles ditto, £138 12s.; 25 miles three twisted conductor wire, £168 15s.; 4 miles ditto, £17 18s.—British Insulated & Helsby Cables, Ltd.

Western Australian Tender Board:—

Insulated Wire Cable, Nos. 1 to 8, Railway Department.—Couche, Callender and Co.

Metropolitan Board of Water Supply and Sewerage, Brisbane:—

Electric jib crane, £520.—J. R. Toole & Co.

Preston Municipal Council, Victoria:—

Supply of meters.—Australian General Electric Co.

—*Tenders.*

Blackpool.—The contract for the electrical installation at the Savoy Hydro., now being erected between Uncle Tom's Cabin and the Gynn, has been secured by Mr. R. Barron of Fleetwood.

Burslem.—The B. of G. has accepted the tender of Messrs. J. Barnett & Co. for a year's supply of electrical fittings, at £57.

Cleckheaton.—The Electricity Committee has accepted the tender of Messrs. Baldwin & Co., for a new isolating valve.

Heston and Isleworth.—The U.D.C. has accepted the offer of Messrs. Browett, Lindley & Co., Ltd., to replace the defective Uniflow engine at present in use at the electricity works by a triple-expansion engine suitable for driving the dynamo now coupled to the existing engine, at an additional cost of £200, and to make arrangements to have foundations laid in a new position and extensions of pipes, &c., made for connecting the new engine.

Ilford.—Messrs. Pritchetts & Gold, the Council's contractors for the supply of plant for the Goodmayes sub-station, have, owing to the war, been unable to deliver the glass containing cells for the battery. Under the circumstances, the Electricity Committee has accepted the firm's offer of wood lead-lined boxes, at a cost of £175 extra on the contract.

The electrical engineer and the chairman and vice-chairman of the Electricity Committee have under consideration a letter from the Sloan Electrical Co. stating their inability to supply arc lamp carbons of Conradty's manufacture, and offering to supply from stock; also, a communication from the Board of Trade calling attention to the shortage of carbons, and making certain suggestions in relation thereto.

The Electricity Committee has accepted the tender of Mr. Geo. T. Walker, at £490, for the erection of workshops at the electricity works.

London.—Stepney.—The B.C. Electricity Committee reports that owing to the regular supplies of coal under contract having ceased on the outbreak of the war, the following offers had been accepted on August 5th:—

A. Blackmore & Co., 100 tons Ibstock Nuts, at 14s. 9d. per ton; W. Cory and Son, Ltd., 300 tons of Washed Peas, at 13s. 6d.; Dinham, Fawcus & Co. 200 tons Scotch Washed Peas, at 15s.; E. Foster & Son, 300 tons Ibstock Nuts D/S, at 15s. 6d.; Harris, Hardman & Co., Ltd., 400 tons Hillhouse Washed Peas, at 13s. 9d.; Harrisons (London), Ltd., 200 tons Gedling Slack, at 16s. 6d.; 300 tons Kilburn Manners Peas, and 150 tons Rutland Peas, at 19s. 6d.; Kerr and Son, 100 tons Nailstone Nutty Slack, at 11s. 6d.

The Committee reports that with a view to supplementing the Council's stock of coal, the following offers were accepted on September 8th and 17th:—

W. H. Bowater, Ltd., 150 tons Clifton Peas, 15s. 7½d.; A. Blackmore & Co. 100 tons Lanarkshire Peas, 14s. 7d., 100 tons Lanarkshire Peas, 14s. 1d.; Cory Bros. & Co., 60/70 tons Clifton Peas, 16s.; 200/300 tons Glascote Nutty Slack, 12s. 6d.; 200 tons Nailstone Slack, 12s. 3d.; Charrington, Sells, Dale, 200 tons Bestwood Peas, 15s. 3d.; Dinham, Fawcus & Co., 200/300 tons Scotch Peas, 16s.; Shipping and Coal Co., Ltd., 600 tons Cowpen Nuts, 15s. 9d.; Edge, J. 200 tons, Griff (Warwickshire) Peas, 15s. 9d.; 250 tons Cossall Screened Peas 16s. 6d.; 200 tons Clifton (Notts.) Peas, 15s. 4d.: Foster, E., & Co., 200/400 ton Walsall Washed Beans, 16s. 3d.; Harris, Hardman & Co., 300 tons Hillhouse Washed Peas, 16s. 3d.; Hudson, J., & Co., 200 tons Bankness Washed Peas, 15s.; Harrisons (London), Ltd., 400 tons Kilburn Manners Peas, 16s.; Hudson, J., & Co. 100 tons Bankness Peas, 14s. 7d.; 200 tons Bankness Washed Peas, 14s. 1d.

The following tenders were received for 50 tons of moulded pitch:—

		Per ton.
T. Crow & Sons	(recommended)	£1 19 6
J. Smart & Son	.. .. ..	2 5 0
Forbes, Abbott & Lennard, Ltd.	.. .. ..	2 11 2
Grindley & Co., Ltd...	.. .. ..	2 12 6
Gillespie & Beales	.. .. ..	2 17 0

The Committee reports having purchased 9,200 pairs of Henrion flame arc carbons, at £72.

The Electricity Committee reports that owing to the difficulty experienced in obtaining supplies of arc lamp carbons, arrangements had been made for fixing on some of the existing lamp columns half-watt lamps, in connection with which the following tenders had been received:—

		Per lamp.
Edison & Swan U.E.L. Co. ..	(recommended)	£1 0 0
Drake & Gorham (Mazda lamps)..	.. .. ..	1 0 0
,, ,, (Osram lamps)..	.. .. ..	1 1 7
British Westinghouse Electric & Manufacturing Co.		1 0 0
Electrical Co.	.. .. ..	1 0 0
Siemens Bros. Dynamo Works. ..	.. .. ..	1 0 0
British Thomson-Houston Co. ..	.. .. ..	1 1 7
General Electric Co...	.. .. ..	1 1 7

The Committee also reports having obtained 70 Wimbledon fittings, without reflectors, for use with above lamps, at 21s. 6d each, from the Foster Engineering Co., and considering it advisable to extend the erection of fittings similar to those in use in Cable Street, the offer of the Universal Electrical Manufacturing Co. to supply 70 fittings, at 37s. each, had been accepted; and also the offer of 10,000 pairs of yellow flame carbons, at £15 5s. per 1,000 pairs, from the G.E. Co., Ltd., had been accepted.

For the protection of the windows at the Limehouse electricity station with wire guards, the tender of Mr. W. Badger, for £71, is recommended for acceptance.

Southwark.—The General Electric Co., Ltd., has been given an order for the supply of 45,000 pairs of 7 × 8 and 8 × 9 mm. carbons to be delivered as and when required during the next 12 months, at £8 7s. 10d. and £9 12s. 2d. per 1,000 respectively. The tender of the same firm is recommended for acceptance for the supply of 20 Angold magazine flame lamps. Owing to the war, the electrical engineer has ordered from the Electrical Equipment and Engineering Co. one mile of 3/20 cable, at £14 10s.; one mile of 7/20, at £26; one mile of 7/22, at £16 5s.; one mile at 7/18, at £32; and one mile of 7/16, at £48 10s.

Rochester.—Amongst orders recently received by Messrs. Venner Time Switches, Ltd., is one for 73 time switches for the Kent Electric Power Co., for Rochester.

Southampton.—The following tenders have been accepted by the Electricity Committee:—

William Rickard, Ltd.—Cable, £96.
Union Cable Co., Ltd.—Small size H.T. cable, £122 per mile.

Stockport.—The B.G. has accepted the tender of Messrs. McClure & Whitfield for the electrical installation at the hospital extension, at £74.

Tottenham.—The Council has accepted the tender of Messrs. N. E. Keen & Co., of Westminster, of £10 for the maintenance of electric fittings. The only other tender, £41, was received from Mr. J. H. Golding, of Stoke Newington.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, October 3rd. Visit to Textile Department, Royal Technical Institute, Salford.

Greenock Electrical Society.—Thursday, October 8th. At 7.45 p.m. Visit Hunter Place sub-station.

Electro-Harmonic Society.—Friday, October 9th. At 8 p.m. At Holborn Restaurant. Smoking concert.

NOTES.

Institution and Lecture Notes.—INSTITUTION OF MARINE ENGINEERS.—On Monday, September 21st, a demonstration was given of the Amalgaline system of metal jointing, by Mr. Harden, the inventor of the process. In marine work, the principal uses to which the system is applied are the flanging of pipes, the seaming of lead used in refrigerating chambers and general sanitary work. The process is now in general use among shipbuilders. It was described in our pages some years ago.

JUNIOR INSTITUTION OF ENGINEERS.—The Council has elected the Marquis of Graham as president for the year 1914-15, in succession to Sir Boverton Redwood. The Vickers Prize, consisting of a Gold Medal and Premium, has been awarded to Mr. James Richardson, for his paper on "High-Power Diesel Engines." Mr. Richardson has also secured the Institution Medal for the same paper.

The following are the announcements for the month of October:

October 9th.—8 p.m. Informal Meeting at 39, Victoria Street, S.W. Mr. Wm. P. Durtnall, on "The Barrier of Ignorance," illustrated by lantern.
October 12th.—8 p.m. At the Institution of Electrical Engineers, Victoria Embankment. Paper by Mr. Wm. Scott Taggart, M.I.Mech.E., on "Cotton Spinning."
October 16th.—8 p.m. Informal Meeting at 39, Victoria Street. Mr. W. T. Dunn, on "The Latest in Home Lighting."
Visit of Sheffield Local Section to the Works of Messrs. Mellowes and Co., Sheffield.
October 23rd.—8 p.m. Informal Meeting at 39, Victoria Street. Lecturette by Mr. H. N. Munro.
October 30th.—8 p.m. Informal Meeting at 39, Victoria Street. Lecturette by Mr. R. Rankin, A.M.I.E.E.

Excellent progress has been made with the Local Sections in Birmingham, Manchester and Sheffield. The membership has considerably increased during the year, and the Committee of each Section is arranging a full and interesting programme for the coming session.

Inquiries.—Manufacturers are asked for of bone or imitation ivory press buttons; brass or german silver springs and screws for wood electric bell pushes, both flat and pear shape; "clear Oyster glasses"; and cheap porcelain cones, 1½ in. to ¾ in. diameter, threaded top and bottom.

The Officer Commanding Royal Engineers, Shoeburyness, would be glad to know of any electric reading or recording tide gauge that is on the market.

All kinds of plant for making metallic-filament lamps are asked for, to start the industry in a neutral country.

Suppliers of "Fontaine bleu" sand for making glass bulbs are asked for.

Manufacturers of machines for winding armatures, winding wire on bobbins, and winding silk, &c., on wire are inquired for.

The Electro-Harmonic Society.—The first Smoking Concert of the season will be held at the Holborn Restaurant (King's Hall), on Friday next, October 9th, commencing at 8 o'clock. Mr. A. Hugh Seabrook will preside. The preliminary programme is as follows:—Vocalists: Mr. Anderson Nicol (tenor), Mr. Thorpe Bates (baritone); Mr. Walter Montague (novel instrumentalist and humorist); Mr. Walter Churcher (humorist); Mr. Ernest Hastings (entertainer at the piano). A professional orchestra from the London Symphony, Philharmonic, and the King's Private Band. At the piano, Mr. Bernard Flanders, A.R.A.M. The programme will include national anthems, patriotic songs and nautical and patriotic selections.

Tungsten Extraction.—At the meeting of the Mawchi Tin and Wolfram Co on Tuesday, it was stated that in order to supply the Sheffield steel makers, arrangements were in progress for the extraction of tungsten from the ore in this country. Hitherto the tungsten used in the manufacture of special steels has come from Germany.

Engineer Units of the Royal Naval Division.—The Board of Selection will continue to interview applicants until the end of this week. Applicants (who must have had actual experience of constructional work) are required to attend in person at 2, Savoy Hill, W.C., between 10 a.m. and 1 p.m., or between 2 p.m. and 4 p.m. (Saturday, 10 a.m. to 1 p.m. only.)

Enemy Patents.—The following statement has been kindly sent to us by a firm of chartered patent agents, who desire to remain anonymous:—It is officially announced that "all persons resident, carrying on business or being in our Dominions," may pay any fees necessary for obtaining the grant, or for obtaining the renewal of patents, or for obtaining the registration of designs or trade marks, or the renewal of such registration *in an enemy country*; and also may pay into the British Patent Office in London on behalf of an "enemy" any fees payable on application for, or renewal of, the grant of a British patent, or on application for the registration of British designs or trade marks, or the renewal of such registration.

The German, Austrian and Hungarian Patent Offices have issued various temporary rules and indulgencies to safeguard certain rights of applicants and patentees which might otherwise have been jeopardised or lost by reason of delays arising out of the hostilities.

Switzerland, though not a belligerent, has likewise provided for special extensions of time for payments and for other matters.

The United States Patent Office, whilst it has no authority to extend the time of filing applications delayed "because of the unsettled condition of European affairs," will probably present the matter to Congress with a view to the obtainment of legislation to remedy the disabilities arising out of such delays.

Canadian Inquiries.—A Winnipeg firm offers to co-operate with United Kingdom manufacturers of electrical goods, hardware, &c., wishing to enter the Western Canada market. A Montreal company, dealing in electrical supplies, wants to get into communication with British makers of tungsten and carbon electric lamps, street and other fittings for same, and arc lamp carbons. Further particulars (names, &c.) respecting these inquiries, can be obtained at the Commercial Intelligence Branch of the Board of Trade in London.

Charge of Stealing.—At the Mansion House Police Court on September 29th, Alexander Farquhar, 39, foreman spinner, was charged, before Sir John Knill, with stealing quantities of copper, brass and zinc, the property of his employer, Mr. David Assersohn, electrical engineer, of 31, St. Bride's Street. Prisoner was charged further with feloniously inciting Frank Brenner, an apprentice, to steal the property of his employer. Prisoner, who expressed regret for what he had done, was committed for trial.

Fire Patrols for Factories.—The British Fire Prevention Committee desire it to be known that a certain number of reserve firemen (over 35 years of age), of good character and experience, are available from the Committee's Special Fire Service Force, to do either part time, or full time watch or patrol service on factories and works engaged upon Government emergency orders. Applications should be addressed to the Registrar, British Fire Prevention Committee, 8, Waterloo Place, London, S.W.

Appointments Vacant. — Junior engineer-in-charge (£2), for Darlington Corporation electricity works. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — MR. BANBURY, shift engineer at the Barnes U.D.C. electricity works, having joined the Army, MR. KIEFFER has been appointed to succeed him until his return.

MR. A. J. DOBSON, meter superintendent at Croydon, has been appointed to a similar position at Hull, recently advertised.

In the absence, on active service, of LIEUT. G. C. MILNES, electrical engineer to the Lancaster Corporation, MR. PEARSON has been placed in charge of the station. Mr. Milnes is serving with the 5th King's Own Regiment.

The following increases of salary are to be granted to the undermentioned employés at the Ilford electricity works:—MR. J. R. WILSON, first charge engineer, £165 to £170; MR. G. E. WILLIAMSON, second charge engineer, £130 to £140; MR. A. GLAZIER, third charge engineer, £127 10s. to £135; MESSRS. P. E. SMITH and T. O. REYNOLDS, meter inspectors, £1 10s. to £2 per week each.

The marriage took place at Vaynor Parish Church, on September 21st, of MR. EDWARD ROWLANDS, of the staff of the Merthyr Electric Traction and Lighting Co., and Miss Annie Dix, eldest daughter of Mr. S. Dix, of Merthyr.

MR. R. W. JOLLY, of the staff of the Blackpool electricity department, has joined the Royal Engineers.

Tramway Officials.—MR. W. R. LORRIMAR, who has left the staff of the Hull municipal tramways department to go into business for himself in the city, has been presented by his colleagues with a silver inkstand.

General.—ALDERMAN WILLIAM THOMPSON, chairman of the Blackburn Electricity and Tramways Committee, has agreed to be nominated for the mayoralty of the borough.

The office staff of the British Insulated and Helsby Cables, Ltd., Helsby, have presented a case of cutlery to MR. A. E. SMITH upon the occasion of his marriage.

MR. H. J. GROVES WEBB, engineer and departmental manager of the Electrical Co., Ltd., Charing Cross Road, W.C., has joined the Royal Naval Division (Engineer Units) and is in the Naval Camp at Martin Mill, near Walmer.

MR. CHARLES BRIGHT, F.R.S.E., delivered a very timely and interesting address on "A Nation's Awakening," at the Leigh Institute on September 18th. A full report is appearing in the *Tonbridge Free Press*.

From an announcement appearing among our advertisements, it will be observed that MR. EDWARD ALBERT UFFELMANN, of Epsom, has adopted the surname of Edwards (Edward Albert Edwards).

Obituary.—MR. R. HOPE-JONES.—We regret to announce the death of Mr. Robert Hope-Jones, M.I.E.E., which occurred suddenly at Rochester, New York State, on the 13th ult. Born in 1859 at Hooton Grange, Cheshire, he was the third son of William Hope-Jones, a pioneer of the Volunteer movement and founder of the 1st Cheshire Rifles, whose annual camp was always held on the estate. The "Hope" represents the Liverpool banking family after which Hope Street and Hope Hall were named. Of musical parents, he was a musician to the finger-tips, and we hear of his playing the organ for occasional services at Eastham Parish Church when he was nine years old. But his life was one

long struggle against ill-health and financial worry, the temperament of the artistic inventor and the successful commercial man being as difficult to harmonise as oil and water. His courage in surmounting these obstacles is described as superhuman, and the mass of inventive work achieved under such disadvantageous circumstances was enormous. After an apprenticeship at Laird Bros., Birkenhead, 1876-1882, he became chief electrician to the Lancashire and Cheshire Telephone Co., Ltd., leaving them in 1889 to develop his invention of the megaphone, a method of increasing the power of the human voice through the application of a compressed air relay. Though then unsuccessful in its application, the principles he enunciated are now used in connection with gramophones. For this purpose he had established a small workshop close to St. John's Church, Birkenhead, of which he was the voluntary organist and choirmaster. Here began his epoch-making inventions in organ building. The improved electro-pneumatic action, the movable console, the high wind pressures, the percussive attack, the double touch, the stop-switch and the stop-keys instead of draw-knobs, startled the organ world, and St. John's Church was visited literally by thousands of organists from all parts of the kingdom. Thanks to liberal financial support from such men as Mr. Thomas Threlfall, then chairman of the Royal Academy of Music, and Mr. J. Martin White, ex-M.P. for Dundee, an organ-building works was established in Birkenhead, and many fine examples of his art were erected such as those in St. George's, Hanover Square, St. Michael's, Chester Square, and Worcester Cathedral.

Mr. J. Hamer.—The death occurred on September 24th, after an operation, of Mr. Joseph Hamer, electrical engineer, of Broad Street, Halifax, and formerly of Sowerby Bridge. Deceased, who was in his 57th year, had been in business at Halifax since 1884, and was a member of the local Electrical Contractors' Association.

CITY NOTES.

Dundee, Broughty Ferry and District Tramways Co.

At the meeting of this company, Mr. George Balfour, moving the adoption of the report, which recommended a dividend of 2½ per cent. for the year, said the directors regarded the result of the year's working as entirely satisfactory. The receipts for the year amounted to £13,986, being an increase of £683 over the preceding year, but expenses, chiefly in coal and maintenance charges, had also increased. The gross profit was practically the same as last year amounting to £6,328. The Dundee Corporation, under the powers conferred on them by the Companies' Act of Parliament, had intimated that they intended to acquire the portion of the company's tramway from Craigie Terrace to Belsize Road, a route length of, approximately, 7 furlongs, and an arbiter had been appointed by the Board of Trade to fix the price to be paid by the Corporation. The company was preparing its claim and would take all steps necessary to support it.

Drake & Gorham, Ltd.

The directors' report for the year ended June 30th, 1914, shows that after payment of all charges, including bonuses due to staff, and making provision for contingencies, there remains a net profit of £8,215, which, with £1,716 brought forward, makes a total of £9,931, which it is proposed to appropriate as follows:—Dividend at the rate of 4 per cent. per annum £5,000, writing down goodwill £3,000, and carrying forward £1,931. After careful consideration the directors have decided not to defer payment of dividends to the shareholders as they appreciate the necessity for maintaining the circulation of money. They gratefully acknowledge the kind support given by many clients during this critical time, which has enabled them to provide employment up to the present for those who have not been able to enlist, and to make provision for dependants of employés who are serving their country. The retiring director, Mr. Edwin H. Story, does not seek re-election.

The dividend paid in 1913 was 5 per cent. per annum, requiring £6,250, £4,000 was written off balance of underwriting commission, and £1,716 carried forward.

La Plata Electric Tramways Co., Ltd.—The directors announce, says the *Financial Times*, that the approximate result for the half-year to June 30th, 1914, shows an available balance of £7,931, as against £9,706 in 1913, and after allowing for debenture stock and other interest, but without any further contribution for reserves or renewals fund, there would remain a balance of £5,212. Having regard to the provision to be made for paving and other payments on capital account and to the existing stringency of the money market, the directors have decided not to pay an interim dividend on the preference shares, but to await the final accounts for the year.

Folkestone Electricity Supply Co., Ltd. — The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

County of Durham Electrical Power Distribution Co., Ltd.—The directors announce that they have decided not to declare an interim dividend on the preference shares.

Buenos Ayres.—The *Financial Times* says that the general stagnation of business in Buenos Ayres, together with the torrential rains, have hit the tramway business pretty hard. Still the report of the South Electric Tramways Co. (Compania de Tramways Electricos del Sud) for the year ended June 30th last is a fairly hopeful one, and the directors are able to recommend the distribution of a 4 per cent. dividend on the ordinary shares. The receipts from tickets have fallen from $1,137,603 in the preceding year to $1,119,190, which works out at a decrease of 1·62 per cent. Unfortunately at the same time the accounts had to bear the extra expenditure entailed by the opening of the branch to the Plaza Constitucion, which took place at the beginning of April, the very time when the excessive rains were beginning to make people keep indoors in the towns, as well as cause the disastrous floods in the country. The extra expenditure consequently was not balanced by the extra takings in the way of fares which had been legitimately hoped for, the outgoings increased from $834,681 to $839,878, and the working coefficient from 73·37 per cent. to 75·04 per cent. The directors are confident that this very high rate will be reduced in the immediate future, for they propose to make a reduction in fares from which they expect the tram business will derive considerable benefit. The company's assets are stated at $6,532,552, the paid-up capital being $3,805,690.

British Radium Corporation, Ltd.—This corporation, at an extraordinary general meeting held in London on 23rd inst., resolved to increase its capital from £40,000 to £50,000. Sir Francis Fox, who presided, said that the new works were now practically completed, and would, he hoped, continue to work at their full capacity in the manufacture of radium salts, uranium and other products.

Hurst, Nelson & Co., Ltd.—The directors report that the accounts for the year ended July 18th, subject to audit, will enable them, after setting aside the amounts required for the dividend on the preference shares payable in November and May next, and placing a substantial sum to reserve, to recommend a dividend of 5 per cent. on the ordinary shares. A year ago 2½ per cent. was paid on the ordinary shares.—*Times.*

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock for the half-year ended October 1st, have been posted.

Kalgoorlie Electric Power Co., Ltd.—A dividend on the preference shares at the rate of 4 per cent. per annum for the six months ended September 30th, 1914, is announced, payable on October 16th.

NEW COMPANIES REGISTERED.

Derby Lamp Works, Ltd. (137,759).—Registered September 23rd, by Ralph Raphael & Co., 17, Coleman Street, E.C., with a capital of £85,000 in 116,500 profit participating cumulative preference shares of £1 each and 274,000 ordinary shares of 5s. each. Objects:—To carry on in the United Kingdom, the Colonies, India, or elsewhere, the business of manufacturers of electric lamps, filaments and radiators of all kinds, stoves, meters, fittings, apparatus and appliances connected with electricity, water, oil, gas or otherwise; electrical, telegraph, telephone, mechanical and consulting engineers; wholesale or retail manufacturers of, and dealers in, chemicals, drugs, preparations, oils, paints, colours, varnishes and other compounds used by photographers, dyers, chemists, druggists or dryalters, &c. The signatories (with one share each) are:—C. B. James, Holme House, Norbury, Surrey, accountant; W. Lee, 19-20, Avenue Chambers, Bloomsbury Square, W.C., director; J. Bransbury, 3, Pancras Lane, E.C., solicitor; A. Beard, 18, Station Road, Annerley, S.E., clerk; C. Burton, 37, Surrey Street, W.C., advertising contractor; C. H. Frost, 3, Pancras Lane, E.C., clerk; J. Clifford, 2, The Mall, Wembley, Middlesex, clerk. Minimum cash subscription, seven shares; the first directors (to be not less than two or more than nine) are W. Lee and H. How; qualification (except the two directors nominated in writing by the liquidator of Metalite, Ltd.), £500; remuneration, £100 each per annum (chairman £50 extra) and a percentage of the profits. Registered office, 9-10, Pancras Lane, E.C.

Parana Tramways Co., Ltd. (137,776).—Registered September 24th, with a capital of £75,000 in £1 shares, to acquire, use, work, dispose of, and turn to account, any tramways, railways or running powers, to generate, purchase and supply electricity for light, heat, motive and traction power and other purposes, &c., and to enter into an agreement with J. G. White & Co., Ltd. The subscribers (with one share each) are:—H. W. Stacey, 60, Trentham Street, Southfields, S.W., accountant; W. E. Hurry, 34, The Avenue, Highams Park, near Chingford, registrar; H. H. Clubb, 61, York Road, East Ham, clerk; F. J. Birch, 2, Castleton Road, Goodmayes, company secretary; O. S. Penton, 9, Lee Park, Blackheath, S.E., cashier; F. R. Simmonds, 204, Lyndhurst Road, Wood Green, N., clerk; F. W. Payler, 3, St. Stephen's Road, Lewisham, S.E., book-keeper. Minimum cash subscription, seven shares; the number of directors is not to be less than three or more than seven; the first are to be appointed by the subscribers; no qualification required for first directors; others, £500 shares, debentures or debenture stock; remuneration as fixed by the company. Solicitors: Julius, Edwards and Thomas, 8, Old Jewry, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sloan Electrical Co., Ltd. (61,528).—Capital, £15,000 in £1 shares (5,000 pref.). Return dated July 17th, 1914, 5,000 pref. and 2,754 ord. shares taken up, £1 per share called up on 1,354 ord., £1,354 paid, £6,500 considered as paid on remainder. Mortgages and charges: Nil.

Naylorgraph, Ltd.—Debenture dated September 16th, 1914, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital, if any. Holder: J. M. Hunt, Fairlawn Park Road, Southborough, Kent.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business continues steadily to expand. Day by day the number of members who come up to Throgmorton Street is augmented by fresh arrivals who have scarcely put in an appearance hitherto, since the end of July. They are attracted by hearing that business is far from being dead. Some firms even boast that they are making income beat expenditure, but this, perhaps, must be taken in conjunction with comparatively light office expenses. Most brokers, for instance, are obliged to maintain relatively heavy charges for office accommodation and its incidentals, which is a source of outgoings that does not so greatly trouble the jobbers, two or three of whom can share a room, a clerk and a telephone, without putting any undue strain upon either of the three.

At the same time, business is very different, of course, from what may be described as normal. It would be waste of space, for instance, to re-set-up the two pages of price lists usual to this part of the Electrical Review. The quotations would be appropriate so far as buying prices are concerned, but since in many stocks it is still a matter of difficulty to find buyers, the re-establishment of regular price lists must still be delayed. If, however, there are readers who would care to see prices regularly, we will do our best to get an actual dealing price and to embody it in the various selections of quotations which we have been enabled to give since the war began.

The Home Railway market continues to show reviving vitality. A good many people are urging that investors have become so sick of losses incurred through the placing of capital in securities hailing from abroad that they must perforce turn to domestic channels for employment of their surplus cash. Prices have undergone extremely severe shrinkage from the best figures touched this year; and while there has been substantial recovery from the worst, the bullish argument is that plenty of scope remains for further advances.

The Underground group is in some favour with what may be termed its usual body of buyers, who, during the past week, have been picking up such amounts of Metropolitan Consolidated, District Ordinary and Underground Electric income bonds as are held to show the presence of the small capitalist. To the the Stock Exchange, these comparatively slender transactions are of little value, save for the indication which they afford of the trend of public opinion. The quotations have improved, notwithstanding quietude and dullness in the Consol market, where the price of the Funds has eased off to 68½, below which figure members are not allowed to deal amongst themselves, on behalf of clients.

Telegraph and Telephone descriptions are very quiet, showing no important changes from the figures given here last week. The feature is the strength of Marconis. The parent shares have risen to $1\frac{9}{16}$, at which price there are supporters as these notes are being written. The firmness is based upon the current impression, already quoted here, that the company is doing extremely well in connection with Government work; and although the Government itself is working the concern, it is thought that the shareholders cannot fail to derive substantial benefit from the business brought by the war. American Marconis, after being down to 8s. 3d., have recovered to 9s.; while Canadians, which were none too readily saleable a few weeks ago, are now a tolerably good market in the neighbourhood of 4s. 6d. The Eastern group is unchanged, and the Anglo-American section has been attracting the attention of the speculative investor.

Amongst Electricity Supply shares there has been comparatively little doing during the past week. No pressure to sell, coupled with not much demand for shares, have combined to reduce the market to a state of stagnation. The companies, from all that we can hear, are doing better than might have been expected, having regard to the state of war, from which it may be inferred, reasonably enough, that a comparatively slight amount of attention would brace prices materially. Metropolitans within the past few days have changed hands at 3 and 3¼. South Metropolitan Preference can be sold at 22s. 6d. There are several buyers of Debenture stocks. South London Debenture, for example, is quoted at 98, and Chelsea Debenture at 90½. Possibly sellers could get these figures for the stocks.

British Columbia Electric Deferred stock at 94 is 12 points down since the Stock Exchange closed, and the 5 per cent. Preference, at 96, is 6½ lower. There is a small scrap of the Company's Preferred Ordinary on offer at 93, or a shade cheaper, this being some 9 points below the price ruling at the end of July.

Mexican utility shares and bonds are scarcely dealt in. The news from the country is bad, and the fresh revolution dashes to the ground the hopes which had been reared upon the elevation of Carranza to the direction of affairs—and, it was hoped, to the permanent handling of the reins of Government. This seems to be knocked on the head by the latest intelligence, and most securities connected with Mexico have gone back. There are still a few hardy buyers of Mexico Tramways bonds, who are prepared to give 73.

Argentine Tramway 5 per cent. Debenture stock is on offer at 93½, free of stamp and fee, which is only 7½ points higher than the price of the company's 4 per cent. First Debenture stock. Buenos Ayres Lacroze Extension Debenture changed hands the other day at 90, and the Consolidated Debenture at 84, these prices being practically identical with those of two months back. Toronto Power Consolidated Guaranteed Debenture stock has come on offer at 90, free; there is a dividend due on November 1st.

Brazilian Tractions rose to 52, but reverted later to the round 50. The shares are moving a good deal in sympathy with the general tone of markets. It would be interesting to know what proportion of the company's Common shares were held in Belgium, but, judging from experience, in the absence of such information, it would not be safe to draw rash conclusions from the known liking of Belgian capitalists for these shares.

British Westinghouse Preference have risen to 1⅛-1½, and, as may well be supposed, all the Armament shares are steady. The feature is the strength of Birmingham Small Arms, the price of which has risen to 55s., which is 12s. 6d. higher than the price was on July 30th. The Company has just issued a glowing report, and there has been substantial buying of the shares in various provincial centres, from Birmingham to Cardiff. Vickers at 34s. 6d., and Armstrongs at 38s. 9d., keep firm. There is a continuance of inquiry for Rubber shares, thanks, of course, to the demand experienced for the raw material in connection with stores and with tires for motor vehicles of all kinds, mostly military and commercial.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, only nominal.

Wednesday, September 30th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	Nom.	..
a " Nitric .. .. .. "	"	..
a " Oxalic .. .. .. per lb.	"	..
a " Sulphuric .. .. .. per cwt.	"	..
a Ammoniac Sal .. .. .. "	"	..
a Ammonia, Muriate (large crystal) per ton	"	..
a Bleaching powder .. .. .. "	"	..
a Bisulphide of Carbon .. .. "	"	..
a Borax .. .. "	"	..
a Copper Sulphate .. .. .. "	"	..
a Lead, Nitrate .. .. .. "	"	..
a " White Sugar .. .. .. "	"	..
a " Peroxide .. .. .. "	"	..
c Methylated Spirit .. .. .. per gal.	"	..
a Potassium, Bichromate, in casks per lb.	"	..
a Potash, Caustic (88/90 %) .. per ton	"	..
a " Chlorate .. .. .. per lb.	"	..
a " Perchlorate .. .. "	"	..
a Potassium, Cyanide (98/100 %) .. " (for mining purposes only)	"	..
a Shellac .. .. per cwt.	"	..
z Sulphate of Magnesia .. .. per ton	"	..
a Sulphur, Sublimed Flowers .. "	"	..
a " Recovered .. .. "	"	..
a " Lump .. .. .. "	"	..
a Soda, Caustic (white 70/72 %) .. "	"	..
a " Chlorate .. .. .. per lb.	"	..
a " Crystals .. .. .. per ton	..	..
a Sodium Bichromate, casks .. per lb.	..	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£88	..
b " Wire, in ton lots (1 to 14 S.W.G.) "	£112	..
b " Sheet, in ton lots .. "	£112	..
p Babbitt's metal ingots .. .. "	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	7¾d.	¼d. dec.
c " Tube (brazed) .. .. "	9¾d.	¼d. dec.
c " " (solid drawn) .. "	8¼d.	..
c " Wire, basis .. .. .. "	7¼d.	¼d. dec.
c Copper Tubes (brazed) .. .. "	9¼d.	¼d. dec.
c " " (solid drawn) .. "	9¼d.	¼d. dec.
g " Bars (best selected) .. per ton	Nom.	..
g " Sheet .. .. .. "	Nom.	..
g " Rod .. .. "	Nom.	..
d " (Electrolytic) Bars .. "	£56	£3 dec.
d " " Sheets .. "	£74	£3 dec.
d " " Rods .. "	£62	£3 dec.
d " " H.C. Wire per lb.	7½ d.	¼d. dec.
f Ebonite Rod .. .. .. "	3/6	1/- dec.
f " Sheet .. .. .. "	3/-	1/- dec.
n German Silver Wire .. .. "	1/7	..
h Gutta-percha, fine .. .. .. "	6/10	..
h India-rubber, Para fine .. .. "	2/9½	1½d. dec.
j Iron Pig (Cleveland warrants) .. per ton	50/11½	1/11½ dec.
l " Wire, galv. No. 8, P.O. qual. "	£16	..
g Lead, English Pig .. .. .. "	Nom.	..
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£7	..
c Mica (in original cases) small .. per lb.	4d. to 2/6	..
c " " " medium "	3/- to 5/-	..
c " " " large .. "	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c. .. .. "	Nom.	..
p Phosphor Bronze, plain castings "	1/1 to 1/3½	..
p " " rolled bars & rods "	1/0½ to 1/2	..
p " " rolled strip & sheet "	1/9½ to 1/5½	..
o Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	..
r Steel, Magnet, in bars .. .. per ton	£141	..
g Tin, Block (English) .. .. "	Nom.	..
n " Wire, Nos. 1 to 16 .. .. per lb.	2/2	1d. dec.
p White Anti-friction Metals .. per ton	£44 to £194	..
k Zinc, Sh'ts (Vieille Montagne bnd.) "	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, [Ltd.
m W. T. Glover & Co., Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

PROBLEMS OF INDUSTRY.*

By "A WOULD-BE REFORMER."

Are the ability and resources of this country competent to carry its responsibilities? Though this question is for decision by the future, we have to find an answer now, and have no real choice as to what that is. We must answer in the affirmative, and make it our business to see that they are competent. But the question of how best to use our resources, and a doubt whether we are doing all that should be done, are continually before us.

The foundation of the national structure is national character, but everyone knows that this is a foundation to be built on with method, discipline, organisation, education, purpose, and many other materials. Here we are told that Germany is outbuilding us, and that we must change our methods, or be content to resign our position in the world.

We have before us Mr. J. J. Hill's recent speech at the National Foreign Trade Convention in the U.S.A., in which he severely criticised British industrial methods, especially in recent legislation, and predicted grave disaster for us in the near future. It is hard for us to accept this bewildering lesson. Can it be that the next generation to that which built the submarine cable system, the ocean steamship lines, the Lancashire cotton industry, the shipyards, fifty other things, is collapsing rapidly and disastrously through want of business methods? In what is it, how is it that we are failing? Or is it possible that Mr. Hill misunderstands the conditions, and we are not failing at all? Can so famous a prophet, with so loud a voice, so impressive a manner, so skilled in finance, though it is only American finance, be wrong?

We have had more than one lesson recently to teach us that not every prophet of woe is a Cassandra. A very few years ago we were scared by dismal calculations of the amount of combined nitrogen in the world, only to be increased by the clover bacillus, and the limited area in which wheat could be grown. Since that time nitrogen compounds have been formed from the air on a scale which can be extended without limit; new strains of wheat have come into use which will ripen in the short sub-Arctic summer; Canadian and Siberian wheat fields have been opened up; irrigation and dry soil culture have brought deserts into cultivation. Could the irony of false prophecy go further?

Let us not be too much frightened by the prospect of disaster from other people's prosperity, but remember that it was impossible for us to remain the workshop of the new world to the extent that we were of the old world from which we were the first to rise. Prosperity does not consist in being bigger than other people, nor even in any given rate of expansion, but in having control of our circumstances and responsibilities. Nevertheless, however we may suspect the spirit in the mouths of these prophets, we do well to consider carefully what they utter.

In the last resort the maintenance of national position may depend on military strength, but every year makes clearer that war between highly organised states is a desperate remedy, and that national competition is in the main one of industrial efficiency and material resources. This is the position Mr. Norman Angell has developed. To a mere onlooker it would seem that the susceptibility of injury of the German Empire increases much more rapidly than her power of inflicting it. Consider what deadly blows we could now, with little injury to ourselves, inflict on her sea-borne commerce, while in 1870 we could not have injured Prussia at all except at our own greater cost. Germany's very industrial activity compelled her to submit in the Moroccan conference when the French bankers withdrew their loans. Her attempt to obtain a position of overwhelming military strength has conspicuously failed, having resulted only in the consolidation of other States against her, so that her military position relatively to them is weaker now than it has been at any time since Jena, and is one of considerable peril. That peril is not the less because she is a standing menace to other nations. The military question does not concern us. It is mentioned here to be put aside, and to emphasise the point that the real problem is that of efficient industrial organisation, and it is of this that the warning is addressed to us.

The subject has been discussed from many points of view, which fall under three principal heads:—

1. The efficiency of the directors and staff of industrial concerns.
2. The organisation of the workers, and their relations to the directors.
3. Free Trade and Protection.

Under the first head falls the large subject of scientific and technical education, and to some extent the working of the Limited Liability Companies Acts. The second heading covers matters connected with Trade Unions, employer's liability, factory Acts, industrial insurance, and similar things. Taking them in the reversed order we will only observe of the Free Trade question that we suspect its practical importance to be greatly exaggerated, but it has occupied so large a space in recent politics that one can hardly leave it unmentioned. It is difficult to draw any definite conclusion from the cases of the U.S.A., Germany, and Great Britain, except that great commercial activity depends on quite other matters than taxation at the ports.

The second head, the problem of the relations between wage-payers and wage-earners, is the subject of that amazing speech of Mr. Hill's to which we have already referred. With some verbal alterations it might be put in the mouth of a confederate slave owner, or of a county member of 1830 defending a 40s. duty on wheat. "Only a purblind nation can dream of basing its future on anything less commanding than equality or superiority in the elements of production; including, of course, the wages of labour, and the remuneration of capital." Yes! Low wages and high remuneration. Again: "Widespread and long-continued industrial distress in England comes from attempting to hold markets against competitors, while maintaining a wage scale that does not permit her to meet their prices, and does not offer to capital an inducement to go into new fields of development, or even to remain where it has hitherto been occupied." Excellent! Let us re-enact the old Poor Law. Does Mr. Hill really think that the work of Zeiss and Abbe, of the Hamburg-America Line, of the Baden Aniline Co., is based on cheap labour? To lay down as axiomatic long and verbose premises in which the desired conclusion is implicitly assumed is the well-known method of public oratory. Of this Mr. Hill's speech is an excellent example, but it is not a very helpful contribution to our present problem of the contest between the employers and the trade unions, which we are meeting in a more advanced form than Germany has yet developed. The problem taxes our political capacity, but we do not believe for a moment that it will go near to ruin us. A working solution has been found in Lancashire, and this may be adopted in other places. The essence of the solution seems to lie in such an intelligence by the workers of the conditions of a business, that they are able to assent to the terms on which it is conducted, instead of being compelled to submit to them. This is clearly more difficult in such a business as a railway than in cofton manufacturing or gas-making, but should be capable of more extensive application than at present.

We turn to the question of the efficiency of the

* We print this article as it was written early in July, though some passages are already obsolete.—Eds. Elec. Rev.

direction and staff, which is the root of the matter, and is closely connected with that of education. There seem to be two weak places in the existing system in England of directing and staffing business concerns. The one is that there is no large body of technically instructed men from whom the directors and staff can be recruited, and the other that there is not sufficient advancement of able men from the lower grades to higher ones inside the businesses. The two points are closely connected, but the second is to a large extent the effect of the Companies Acts, and our system of banking. The capital of British concerns is largely obtained on the Stock Exchanges, and is owned by bodies of persons generally ignorant of the business and interested only in the dividends, and a tendency to appoint directors to the boards who represent the purely financial interests of the shareholders is inevitable. The experience and ways of thought of these men are those of financiers. The technical men, the managers, engineers, and so forth are in an inferior position. The directors neither use quite the same language nor think quite in the same way as their subordinates. The energy and enterprise along technical lines which—judging from their trade journals—are the life of American businesses, are stifled; and the worst result of this is that the directors are not sufficiently in command of, or in touch with, their businesses to be able to recognise with certainty, and advance with decision, younger men of energy and ability who may be found in their service. It was a very true saying of Lord Melbourne that England is a great reservoir of capacity. No head of an English business who has a considerable number of men under him, and possesses sympathy and insight, should ever be at a loss to find a man capable at least of any piece of work or administration for which in the ordinary occasions of business a man may be wanted. For supreme occasions the supreme man may or may not present himself. But a financial director, of experience and capacity, often the successful head of some allied business, or representing the interest of an important shareholder, attending a board meeting every week or fortnight, careful to refrain from doing anything to affect the position of the manager especially in his relation with the staff—such a director knows little of the men and of whose ability he may be in sore need, and yet at the same time occupies the position in which alone the decision to advance the able men can be made. The question of the advancement of any given man, and the estimate of how he will fill the higher post, is so much a matter of personal judgment, and there is so good a chance of mistake, that a subordinate officer, even a general manager under a board, will rarely take the responsibility of urging such a step.

One is tempted to think that German businesses may have an advantage over ours in both these points. On one side their system of technical education should help to bring out the capable men, and enable them more readily to be recognised, and promoted to higher posts. On the other hand German businesses are financed to a large extent by bankers, not as here, where the banks merely make advances on security and have no interest in the way the money is used, but by bankers whose security is the prosperity of the concern itself. This should result in the choice of directors for their experience and knowledge of the particular business they are to conduct, and for the purpose of actively conducting it, and such men will be more easily found under the better educational system. Of course, these remarks are of limited application. The articles of association and shareholders' registers of Lancashire mills not unusually consist of a list of subscribers' names and amounts in a penny note-book, the directors being men of practical experience taken from the list. As a direct and businesslike method, this would be hard to beat. So anyone can call to mind large and important limited firms whose direction is of the highest order in intelligence and skill. Nor is any change suggested in banking methods. Though it might be well for industrial concerns that their invertebrate bodies of shareholders should be replaced by small committees of bankers, it would be bad for the banks. That is not banking business as we practise it. Nevertheless, though committees of financiers responsible only to general meetings of shareholders seem to conduct banking, insurance, and some other businesses satisfactorily, they are not satisfactory in industrial concerns; and we should like to see some system tried in which the business initiative lay with more technically qualified bodies than the present boards usually are.

We turn to the educational system. The basis of our educational system is almost purely literary and of immense antiquity. The syllabus of the large endowed schools and grammar schools founded from the 14th century onwards was exclusively the traditional classical system of the middle ages which held the universities. The only effect of the revival of Greek learning in the 16th century was to establish letters still more firmly as the one educational system, and this has never been displaced. The introduction of elementary Greek, geometry, and a little mediæval algebra hardly affects its character. Oxford and Cambridge still insist on a certain minimum of classical learning for all their students, a minimum so low as to be useless to anyone, especially to those who are to be scholars; so high as to involve a serious waste of time and effort by those who are not. This is not merely foolish tradition: the thing has meaning. Letters in the wider sense, literæ humaniores, is the method of human intercourse. The language and ideas in which men sympathise with, influence, rule, one another; the speech which the governors of the world have used, have been those of Aristotle and Cicero, not those of Euclid or Newton. It is interesting to note the men who to-day are chosen to be heads of Universities in the northern towns, where science would seem to be a predominant interest. Mr. Sadler at Leeds, Mr. Fisher at Sheffield, Mr. Hadow at Newcastle. Humanists of humanists. The very men whom More and Colet would have chosen for those posts. The function of English Universities has always been in the language of their bidding prayers "to bring up a succession of persons duly qualified to serve God in Church and State," and that implies a literary curriculum. Here we have the crux of the matter. The absorbing interest of the world is no longer the Church, scarcely the State, and few of us are to do our work in either. The great majority of us are to earn our living in business in some form, and in this democratic age the world is for us and not for our betters. The world's interest is industrial, and the appropriate training is scientific. only in a secondary degree literary.

Now for a scientific training our secondary school system had at one time no resources at all, and no teachers were available. But things are changing fast, and serious attempts are being made to give the training required. All schools teach some science, and the equipment of some of the wealthier schools is excellent. Botany, horticultural and agricultural, is being taught in the County Council schools in country towns with admirable effect, its value and interests being of course readily intelligible in such places. The interest of the science schools in Oxford and Cambridge is now as great as that of the others, and considerably greater in other universities. It is certain that the change will go much farther; that pupils will learn more science, some much more; that universities will abolish their classical qualification for science students; that teachers will improve in skill and in numbers; that their schools will be thronged. Now, is this sufficient? Is the change proceeding along the right lines? Is it moving fast enough? Will it go far

enough? One is tempted to ask: Is it in the German spirit?

It is clearly not in the German spirit. That a whole nation should act for a time as if all its members had but a single brain and a single purpose is not unknown in history, but such action has commonly been under the stimulus of war. Except perhaps in Japan, it is difficult to find a parallel to the intelligent, orderly, consciously directed, persistent movement of the German nation during the last seventy years. The whole people seem to have had the brain to imagine an ambitious ideal, and to understand what efforts and sacrifices were necessary to reach it. They have shown submission to discipline and long perseverance, and these in spite of, perhaps by the help of, an elevated and romantic individualism. A very important part, perhaps the most important part, of the German method has been the education of the people, and here the results have been extraordinary. In all branches of learning Germans have excelled. In accurate and minute scholarship, in historical research, in philosophy, in literary criticism, the German standard of achievement is the very highest, but it is in scientific training that they are admittedly pre-eminent. This is conspicuously the result of method and thoroughness, not of any peculiar originality. It is the mass of work done, and the number of workers trained that is imposing, rather than the actual advance in knowledge. Our chemists and glassworkers, to mention only two trades, are overpowered by the trained specialists whom Germany now commands; and there is no industrial occupation in which similar results may not be attained. Even in shipbuilding Germany promises soon to challenge our position.

On considering in detail how this has been done, one is immediately struck with the system of separate secondary schools for literary and for scientific or technical teaching. This division recognises, what seems to us to be evident, that scientific studies give an education which touches human life at a sufficient number of points, which is in a word sufficiently broad, to be a satisfactory training for the bulk of an industrial nation. Fifty years ago this could hardly have been held, certainly not one hundred years ago. Botany, already alluded to, illustrates this point. As taught now in country schools a better subject of education could hardly be imagined. The systematic botany of fifty years ago would have been little better as a mental stimulant than Latin verses or quadratic equations.

The step now required in this country is the establishment of a system of secondary schools having a curriculum definitely based on science, and recognition of it by the Universities as a normal course of education. Students would be taught to think in terms of physics, chemistry, and biology. Experiment and observation on the one hand, simplified mathematical process on the other, would be the educational methods. Literature, music, history, would be accessory studies. Study will be less irksome to both teachers and pupils as the subjects are more intelligible, while the average mental training will be stricter and more exact than is possible now. With experience and practice the elementary ground necessary to be traversed by beginners will be covered more rapidly and easily, wider ranges of the subjects will be possible, and the pupil's outlook and understanding of the interconnection of the whole will be increased. Education will be widened, not narrowed. Then from large numbers of young men trained from an early age to think in the terms and ideas which lie at the root of all industrial processes, we may look for those who have the special knowledge, as well as the natural ability, to direct our industrial concerns.

It is clear that we are moving in this direction slowly and not very directly, and are somewhat uncertain as to what we are doing. The County Council schools accidentally established in a moment of official abstraction by the whiskey clause dropped into the Act of 1902, controlled by Councils elected for fifty other reasons than educational interest; piloted by the devil of denominationalism in the deep sea of increased rates; superintended by directors of education, versatile and cultivated humanists; stimulated by the wheedling remonstrances and gentle encouragements of H.M. Inspectors—how shall these schools, any more than those under the Public School tradition, do for us what the Real Schulen have done for Germany? The schools themselves are good within the limits of the limited curricula; the heads are keen, thorough, conscientious; the teachers young, hardworking, ambitious; the children come from an intelligent race; the inspectors judicious, experienced, helpful. But there is no efficient, supreme direction; no head to set a continuous policy, to adjust means to a distant end, to adhere firmly to its course, to do for us in short what the German Government has done for its people. In a word, the single Will is wanting. Cannot the urgent necessities of industrial progress supply the driving power required to establish the schools we need?

TRADE STATISTICS OF JAPAN, 1913.

The following statement showing the imports into and the exports from Japan of electrical and similar goods during the year 1913 is taken from the recently issued official trade statistics; the figures for 1912 are given for purposes of comparison, and notes of any increases or decreases are added:—

	1912. Yen.	1913. Yen.	Inc. or dec. Yen.
Galvanised iron wire.—			
From Great Britain ...	370,000	233,000	– 137,000
,, Germany	2,385,000	2,043,000	– 342,000
,, Belgium	125,000	122,000	– 3,000
,, Austria	9,000	—	– 9,000
,, United States ...	608,000	41,000	– 567,000
,, Other countries ...	2,000	8,000	+ 6,000
Total	3,499,000	2,447,000	– 1,052,000
Rails.—			
From Great Britain ...	137,000	555,000	+ 418,000
,, Germany	671,000	1,197,000	+ 526,000
,, Belgium	575,000	211,000	– 364,000
,, United States ...	2,475,000	1,922,000	– 553,000
,, Other countries ...	81,000	201,000	+ 120,000
Total	3,939,000	4,086,000	+ 147,000
Posts for electric wire materials for buildings, etc.—			
From Great Britain ...	505,000	802,000	+ 297,000
,, Germany	383,000	832,000	+ 449,000
,, United States ...	1,174,000	1,146,000	– 28,000
,, Other countries ...	85,000	92,000	+ 7,000
Total	2,147,000	2,872,000	+ 725,000
Copper (pipes and tubes).—			
From Great Britain ...	156,000	251,000	+ 95,000
,, Germany	37,000	22,000	– 15,000
,, Other countries ...	7,000	14,000	+ 7,000
Total	200,000	287,000	+ 87,000
Insulated electric wire.—			
From Great Britain ...	2,622,000	491,000	– 2,131,000
,, France	15,000	2,000	– 13,000
,, Germany	2,485,000	1,419,000	– 1,066,000
,, Italy	4,000	—	– 4,000
,, United States ...	261,000	96,000	– 165,000
,, Other countries ...	1,000	3,000	+ 2,000
Total	5,388,000	2,011,000	– 3,377,000
Cranes.—			
From Great Britain ...	738,000	426,000	– 312,000
,, Germany	53,000	473,000	+ 420,000
,, United States ...	110,000	173,000	+ 63,000
,, Other countries ...	8,000	7,000	– 1,000
Total	909,000	1,079,000	+ 170,000

Gas engines, petroleum engines and hot air engines.	1912. Yen.	1913. Yen.	Inc. or dec. Yen.
From Great Britain ...	989,000	577,000	− 412,000
,, Germany	167,000	359,000	+ 192,000
,, Belgium	7,000	7,000	—
,, Sweden	114,000	97,000	− 17,000
,, United States ...	55,000	80,000	+ 25,000
,, France	52,000	23,000	− 29,000
,, Italy	—	14,000	+ 14,000
,, Switzerland ...	—	59,000	+ 59,000
,, Other countries ...	6,000	—	− 6,000
Total	1,390,000	1,216,000	− 174,000
Steam engines.—			
From Great Britain ...	218,000	219,000	+ 1,000
,, Germany	45,000	223,000	+ 178,000
,, United States ...	98,000	27,000	− 71,000
,, Belgium	—	94,000	+ 94,000
,, Other countries ...	—	6,000	+ 6,000
Total	361,000	569,000	+ 208,000
Steam boilers.—			
From Great Britain ...	1,000,000	660,000	− 340,000
,, Germany	89,000	150,000	+ 61,000
,, United States ...	86,000	77,000	− 9,000
,, Belgium	—	89,000	+ 89,000
Total	1,175,000	976,000	− 199,000
Dynamos, electric motors, etc.—			
From Great Britain ...	1,323,000	1,035,000	− 288,000
,, Germany	1,199,000	1,460,000	+ 261,000
,, Italy	2,000	—	− 2,000
,, Switzerland	7,000	49,000	+ 42,000
,, United States ...	1,605,000	1,706,000	+ 101,000
,, Sweden	—	18,000	+ 18,000
,, Other countries ...	5,000	22,000	+ 17,000
Total	4,141,000	4,290,000	+ 149,000
Water turbines and Pelton wheels.—			
From Great Britain ...	59,000	37,000	− 22,000
,, Germany	790,000	613,000	− 177,000
,, France	7,000	4,000	− 3,000
,, Switzerland	15,000	—	− 15,000
,, Sweden	7,000	21,000	+ 14,000
,, Belgium	—	14,000	+ 14,000
,, Denmark	—	26,000	+ 26,000
,, Italy	3,000	13,000	+ 10,000
,, Other countries ...	—	1,000	+ 1,000
Total	881,000	729,000	− 152,000
Wattmeters.—			
From Great Britain ...	188,000	30,000	− 158,000
,, Germany	189,000	149,000	− 40,000
,, United States ...	147,000	80,000	− 67,000
,, Other countries ...	—	2,000	+ 2,000
Total	524,000	261,000	− 263,000
India rubber and gutta percha, crude.—			
From British India ...	282,000	479,000	+ 197,000
,, Straits Settlements	1,642,000	1,771,000	+ 129,000
,, Dutch India	146,000	18,000	− 128,000
,, Great Britain ...	461,000	818,000	+ 357,000
,, Germany	39,000	21,000	− 18,000
,, United States ...	321,000	200,000	− 121,000
,, Other countries ...	138,000	145,000	+ 7,000
Total	3,029,000	3,452,000	+ 423,000

The exports of electric machines and parts thereof from Japan in the years 1912 and 1913 were as follows:—

	1912. Yen.	1913. Yen.	Inc. or dec. Yen.
To China	7,000	2,000	− 5,000
,, Kwantung Province ...	171,000	249,000	+ 78,000
,, Philippine Islands ...	101,000	155,000	+ 54,000
,, Siam	1,000	1,000	—
,, Australia	4,000	10,000	+ 6,000
,, Hong Kong	28,000	13,000	− 15,000
,, British India	14,000	19,000	+ 5,000
,, Straits Settlements ...	5,000	2,000	− 3,000
,, United States	2,000	—	− 2,000
,, Other countries ...	7,000	19,000	+ 12,000
Total	340,000	470,000	+ 130,000

Yen = 2s. 0½d.

ELECTROLYTIC IRON.

By L. GUILLET, D.Sc. (Professor of Metallurgy at Paris).

(*Abstract of paper contributed to the* Iron and Steel Institute, *September*, 1914.)

The industrial manufacture of iron by electrolysis is a problem which has engaged attention for many years, but it is only within the last year that it has entered the practical stage.

Since 1910 the company "Le Fer" at Grenoble took out patents for the manufacture of electrolytic iron. In principle, the method consists in the use of a revolving cathode and a neutral solution of iron salts, maintained in the neutral state by the circulation of the liquid over the surface of the iron. The bath also receives periodic additions of a depolarising medium, such as oxide of iron, the object of which is to eliminate, at least in part, the hydrogen deposits on the cathode, which injuriously affect the material if present in too large a quantity. By these means it is possible to work with a current of high density (1,000 amperes to the square metre), and an iron of excellent quality is obtained. The process is applicable either to the production of very pure iron, which can compete with the best iron and Swedish iron, or to the direct manufacture of tubes and sheets in the finished state. It has emerged from the laboratory stage, and is now being put into operation on an industrial scale.

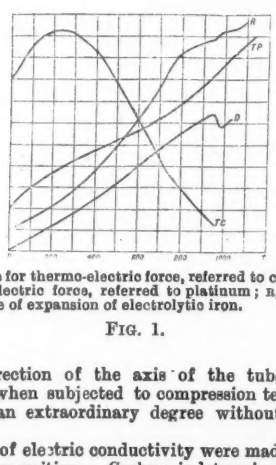
The works of St. Marie and Gravigny and the Bouchayer and Viallet Co. have acquired from "Le Fer" the options on a licence to manufacture sheets and tubes respectively. Messrs. Bouchayer and Viallet displayed commercial tubes at the Lyons Exhibition, and have just completed the work of a large department, which is about to begin the continuous manufacture of tubes.

The practical results obtained may be summarised as follows:—

1. With regard to the character of the metal. Using any pig-iron in solution, an iron can be obtained of the following average composition, after removal of the gases by annealing: Carbon 0·004, silicon 0·007, sulphur 0·006, phosphorus 0·008 per cent. By the aid of certain operations the percentage of phosphorus can be made very low. At the present time it is possible to guarantee phosphorus lower than 0·010 per cent. The pig-iron used in the production of the electrolytic iron in question had the following composition: Carbon 2·35, silicon 1·31, sulphur 0·07, and phosphorus 1·07 per cent. With a density of current of 1,000 amperes per square metre, the yield per KW.-year is 2 tons of metal, including the current for the accessory services, particularly for the rotation of the cathodes.

2. As regards industrial products. The manufacture of tubes is being proceeded with on an industrial scale. The metal deposited is extremely brittle and hard, due to the occluded hydrogen, and probably also to interstrain. Since the deposition of the iron takes place on a metal mandrel, the whole is annealed, and the finished article is easily withdrawn from the mandrel. The current practice of the Bouchayer & Vaillet Co. is to manufacture tubes of a length of 4 m., 100 to 200 mm. in diameter, and with a thickness of 0·1 to 6 mm. Their installation is capable of turning out at least 100 tubes per day. Apparatus is also in course of construction to enable the diameter of the tubes to be considerably increased. The manufacture of sheets is at present the subject of investigation. After annealing, the crude iron possesses all the requirements of an excellent metal capable of fusion.

After annealing for two hours in magnesia at 900°, the iron shows a Brinell hardness of 90. The micrographic structure is perfectly normal. The tensile test gives a breaking strength of 30·9 to 32·8 kg. per sq. mm., and an elongation of 40·2 to 42·1 per cent. in the direction of the axis of the tube. Further, the annealed tubes, when subjected to compression tests, can undergo deformation to an extraordinary degree without a sign of any fracture.



T C, Heating curve for thermo-electric force, referred to copper; T P, Heating curve for thermo-electric force, referred to platinum; R, Curve of electric resistance; D, Curve of expansion of electrolytic iron.

Fig. 1.

Measurements of electric conductivity were made on an iron of the following composition:—Carbon, indeterminable; manganese, nil; silicon, nil; sulphur, nil; phosphorus, 0·025; arsenic, 0·011. The mean of the determinations carried out with the Thomson bridge on four turned bars of electrolytic iron, 5·70 mm. diameter and 120 mm. long, after annealing, was 10·22 microhms per cm.^{3}

Similar determinations made on small rectangular unannealed bars of 5·1 × 6·1 mm. in cross section and 120 mm. long have given a value of 12·16 microhms per cm.^{3} at 20°.

On the other hand, Broniewski has obtained results of measurements on an electrolytic iron from the same source as that stated by the present author, which are shown in the accompanying fig. 1,

which gives the heating curves for the thermo-electric force referred to copper (T C) and referred to platinum (T P), the curve of the electric resistance (R) and the curve of expansion (D) of the iron.

The curve of the thermo-electric force of the iron referred to copper (1 division representing 0·5 millivolt) shows a critical point at 730° C. The curve of thermo-electric force referred to platinum enables higher temperatures to be attained, but on a smaller scale (1 division representing 2 millivolts), and it shows a critical point at 1,020°.

The curve of the electric resistance of iron (1 division representing the electric resistance at 0°) shows between 750° and 850°, a perfectly continuous change of direction which it would be difficult to assign to a critical point. A discontinuity in the course of the curve is manifested at 950° and 1,020°, with a change of direction between these two temperatures.

The curve of expansion (1 division representing 0·002 of the length of the specimen at 0°) shows in the neighbourhood of 950° a maximum followed by a contraction.

The industrial applications of electrolytic iron fall into three principal categories:—(1) The direct manufacture of tubes; (2) the direct manufacture of sheets; (3) the preparation of pure iron as a raw material intended for fusion. There are various other uses of less importance, such as the preparation of rods of very pure iron for autogenous welding.

All present methods of manufacturing tubes present certain insurmountable difficulties when it is desired to obtain regular thicknesses of less than 6 mm. With the electrolytic process it is possible to obtain the most satisfactory regularity whatever the thickness, diameter, and length of tube. The tubes will withstand considerable pressures.

The sheet-iron is of first-class quality, capable of undergoing very considerable deformations in the cold. Tests on tubes and plates have been made in the draw bench, and it is surprising with what facility the metal can be worked. The material is therefore highly suitable for purposes of stamping, both in the form of plain annealed plates (black plates) and of tinned plate. Finally, on account of their purity, these sheets are specially adaptable for use in the construction of electric machinery. The efficiency of alternating motors and transformers, and also of direct-current motors, is increased by using this material in their construction. The use of electrolytic iron constitutes a real progress, both as regards hysteresis and permeability. In transformers the saving in weight of material is 33 to 40 per cent. The capacity of alternating motors can be increased by 50 per cent. running at the same temperature and occupying the same space. In direct-current machines 16 per cent. of iron can be saved.

Without doubt electrolytic iron will be able to compete successfully with Swedish iron for fusion. The quality is much more regular, and the crude metal, being very brittle, can easily be broken into pieces of any required size, however small, and, at the same time, it can be supplied in suitable thicknesses. The cementation of such products would be more regular than those ordinarily used. Tests made at various steelworks have shown that tools and special steels manufactured from this material give results at least equal to those obtained with Swedish iron. The cost price is the only remaining consideration.

The principal factors which make up the cost price are the electric energy and the pig-iron. It has already been mentioned that 2 tons of extremely pure iron can be produced per KW.-year. Using a current of 500 amperes per square metre, instead of 1,000 amperes, the voltage drops to about one-half, and the production per KW.-year is nearly doubled. Working with a still lower density, the yield can be even further increased. In countries where the cost of motive power is high, it would pay to work at 500 amperes or even less. It would then be possible to produce 3 to 4 tons, and even more, per KW.-year. If the cost of the unit be taken at 1 centime (0·1d.), an ordinary figure in the Alps, and using a current density of 1,000 amperes, the cost of current would not exceed 43 francs per ton of iron produced. Since pig-iron is used as the raw material, it may be reckoned that there is about 10 per cent. of waste in the form of sludge, graphite, &c. The price of the pig-iron would vary according to the locality, and in the mountainous country it would run at about 64s. to 88s. per ton. The price, however, would be higher in those localities where the electric current was cheapest, and *vice versâ*. The average outlay on pig-iron per ton of electrolytic iron would therefore be from about 72s. to 80s. To this would still have to be added the cost of labour, maintenance, cost of electrolyte, depreciation, and interest on the capital cost of the plant. These various amounts have not yet been definitely ascertained, but the total cost price, based on current prices for material and labour, of the electrolytic iron, in the condition in which it leaves the electrolyte bath, would probably not exceed £6 to £7 12s. per ton, according to the locality.

UTILISATION OF HEAT CONTAINED IN SLAG.

By W. L. JOHNSON (Middlesbrough).

(*Abstract of paper contributed to the* Iron and Steel Institute, *September*, 1914.)

Some four years ago Messrs. Bell Brothers began experiments with a view to using the steam produced from slag in a low-pressure turbine. The slag used was that produced in the manufacture of ordinary Cleveland iron.

The apparatus (fig. 1) for producing the steam consists of a wrought-iron circular vessel B Near one edge of the top plate of the granulator B is the hole through which the slag is poured; on the underside of this top plate and round the hole a circular ring 4 in. deep is fixed, which dips into the water to a depth of 3 in., thus forming a hydraulic seal, and preventing the steam from escaping; inside the granulator are four vanes fixed on a vertical shaft D, which cause the water to rotate. The slag comes from the furnace along the trough or channel A. When the slag drops into the water it granulates, and its velocity causes it to sink a certain depth. It floats for a time, but the rotation of the water causes it to come to the surface inside the vessel, otherwise it would block up the slag entrance; the granulated slag is then lifted by the elevator E into a second seal F, and there becomes waterlogged, sinks through the seal, and is taken by a second elevator and dropped into trucks. The feed water is introduced along with the slag at C; the surplus water which drains from the truck is also pumped back to C by a small pump fixed to the side of the apparatus. The steam generated comes off at G; at first it was intended to use this steam direct in an exhaust steam turbine. After numerous experiments on blades of different metal, it was found that duralumin was affected very slightly, and a 50-KW. turbine with blades of this material was experimented with.

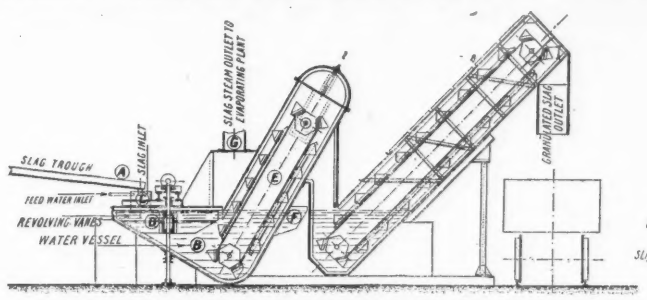


Fig. 1.—Slag Steam Generator.

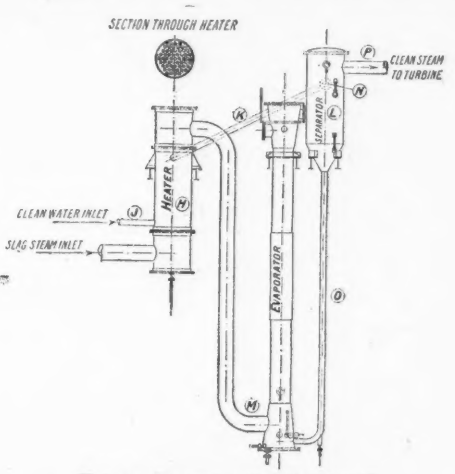


Fig. 2.—Heater and Evaporator.

The steam produced contained about 0·5 per cent. by volume of incondensable gases, which were absorbed between the condenser and the air pump. The nitrogen was dealt with by the air pump. Under these conditions the plant ran for two months; at the end of that time the turbine was opened out, and the openings were found to be partly blocked up with fine sulphur, which had caused some wear of the blades.

The direct method was then abandoned, and a water heater and heat exchanger were introduced between the turbine and the primary generator. The water heater consists of an outer casing and tube plates with tubes 1¾ in. diameter fixed therein, placed vertically, the total heating surface being 156 sq. ft.

The calandria (a Kestner single-effect climbing film evaporator) consists of two parts, the calandria proper and the separator (fig. 2). The former is composed of a shell or casing containing the evaporating tubes, which are about 23 ft. long and 1 7/16 in. in diameter, and are fixed in upper and lower tube plates. The water is fed into the lower end of the heater H and J, and then passes from the upper end by the pipe K into the separator L. The dirty steam from the generator B passes inside the tubes of the heater, the clean water being on the outside, and the uncondensed remainder enters the calandria at M.

The water in the tubes is caused to boil by the steam with which they are surrounded, and as ebullition takes place a column of vapour rises up the centre of each tube. This vapour travels at a high velocity, carrying with it a film of water on the inner surface of the tubes. The water does not "climb" by capillary

attraction nor by the liquid and the steam forming alternate links in the same way as in a Pohle air-lift. The operation is performed in a simple manner; the water begins to boil in the tubes, and is gradually drawn up in a complete film by the vapour itself. As a result of this action a certain amount of water is carried up into the separator L, which acts as a steam drier; this water and the feed water from the heater, which enters at N, flow down the pipe O, entering the calandria at the bottom. The clean steam is delivered by the pipe P to the turbine, which is connected with the condenser in the usual manner. The sulphur deposited in the tubes of the heater is brushed out, and that in the calandria is removed by occasionally filling the dirty steam space with a dilute solution of caustic soda and heating with steam. There seems to be very little corrosion of the tubes of the heater or calandria; and after four years of intermittent working the primary generator does not show any signs of undue corrosion, the shafts of the elevator having a very thin black skin on the surface only.

The heating surface of the calandria is 548 sq. ft. A vacuum of about 9 in. of mercury is maintained in the separator, so that the water boils at 90°-91° C. With steam from the slag at 100° C. and keeping a temperature in the calandria of 91°, the mean of 22 experiments gave 173 gallons of water evaporated per hour, and the average steam per hour condensed in the calandria and heater was 190·2 gallons. The feed water entered the heater at an average temperature of 24·6° C., and entered the calandria at an average temperature of 89°, that is, 91 lb. of clean water was evaporated for every 100 lb. of steam from the slag.

As the condensation of dirty steam takes place, the percentage of incondensable gases naturally increases. When the percentage gets above 7·5 the calandria begins to lose its efficiency, and it is advisable not to allow that percentage to be exceeded. In order to control it a small outlet pipe is arranged on the top of the calandria, where the incondensable gases are drawn off together with a small proportion of steam; with 0·5 per cent. of gas in the dirty steam there will be a loss of 6·6 per cent. of steam.

Experiments were also made to determine the amount of available steam from the slag by condensing and measuring it. The mean of seven experiments gave 1,017 lb. per ton of slag, and deducting 6·6 per cent. for escape with the incondensable gases there are left 950 lb., and 90 per cent. of this gives 855 lb. of clean steam available for the turbine. Since modern exhaust-steam turbines with a full load and a vacuum of 28½ in. can be guaranteed under the above conditions to use not more than about 27 lb. per H.P.-hour, this gives 31·6 H.P. per ton of slag per hour.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thomson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,595. "Electric switches." F. B. Holt. September 9th.

19,737. "Sparking-plugs for internal-combustion engines, and the manufacture of the same." A. A. Lines & H. G. Longford & W. A. Clark, trading as Sphinx Manufacturing Co. September 14th.

19,784. "Electric ignition mechanism for internal-combustion engines." C. C. W. Simpson. September 15th.

19,794. "Electromagnetic switches." British Thomson-Houston Co., Ltd. September 15th. (General Electric Co., United States.)

19,809. "Process for producing the lining of an electric induction furnace." G. Brustlein. September 15th. (Complete.)

19,818. "Electrically-driven clocks." F. H. Walker. September 15th.

19,849. "Treatment of materials for impregnating them electro-osmotically." Ges. fur Elektro-Osmose m.b.H. September 16th. (Convention date, September 19th, 1913, Germany.) (Complete.)

19,854. "Electric signalling systems particularly for use in mines." Sterling Telephone & Electric Co., Ltd., & H. W. Barclay. September 16th.

19,878. "Material for the insulation of electrical conductors." W. Teggin & London Electric Wire Co., and Smiths, Ltd. September 17th. (Complete.)

19,882. "Electric cable." C. J. Beaver & E. A. Claremont. September 17th.

19,886. "Sparking-plugs for internal-combustion engines." T. Crosbee & Sons, Ltd., and D. McGregor. September 17th.

19,891. "Interchangeable gas and electric light fittings." A. C. Eberhardt & E. A. Short. September 17th.

19,908. "Electrical conduit fittings." J. R. A. Hemming & A. E. Beck. September 18th.

19,931. "Means for attaching electric lamps to the handle-bars of motor cycles and like purposes." W. G. Craigen. September 18th.

19,942. "Metal working." British Thomson-Houston Co., Ltd. September 18th. (General Electric Co., United States.)

19,943. "Electric rheostats." British Thomson-Houston Co., Ltd. September 18th. (General Electric Co., United States.)

19,944. "Electrical system for transferring cars." T. F. Mullaney. September 18th. (Divided application on 10,619/14. April 29th.) (Complete.)

19,977. "Electric lighting and heating of railway or other vehicles." C. H. Vidal. September 19th. (Complete.)

19,984. "Semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., W. Aitken, & D. C. Crowe. September 19th.

South Africa.—The Customs Authorities of the Union of South Africa have recently given a decision to the effect that "Wireless telegraphy apparatus" is to be classified under No. 114B of the Tariff, the general duty being at the rate of 3 per cent. *ad valorem*, and the whole of this being returnable in the case of British manufactures.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,606. Galvanic Cells. J. C. N. Eastick. August 30th.

19,676. Timing Apparatus for Making and Breaking Electric Circuits. K. F. Richmond. August 30th.

19,965. Electric Contact-makers or Switches, particularly those used in connection with Electric Motor Horns. W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. September 4th.

20,011. Telephone Exchange Systems. M. L. Johnson. September 4th.

20,562. Safety Warning Signals for Railways. M. B. Cooper. September 11th.

21,428. Telegraph Instruments used in Block Signalling on Railways. R. R. Harper. September 23rd.

21,446. Tiles for Carrying and Protecting Electric Cables, Gas Pipes, Water Pipes and the like. A. J. Howard. September 23rd.

21,678. Construction of Electric Switch. Aldous & Campbell, Ltd., and C. F. Archer. September 25th.

21,735. Switching System for Handling Traffic in one direction only between two trunk exchanges, in each of which the connection of the concerned subscriber lines with the junction lines is obtained by means of an order wire service. C. R. H. Arntzenius. September 26th. (September 26th, 1912.)

22,149. Dynamo-electric Machines provided with Commutators. H. Mensforth. October 1st.

24,559. Electrolytic Apparatus. J. T. Niblett. October 29th.

24,949. Means for Cutting-out and Re-inserting the Resistance in Electric Motor-controllers of the Drum Type. F. M. Marvin. November 1st.

25,977. Electrically-operated Clock Mechanism. E. C. Clerc. November 12th. (November 21st, 1912.)

26,149. Method of Manufacture of Electric Insulation between two Metallic Bodies. S. G. Leach and H. F. Joel, Jun. November 14th.

26,198. Pulleys for the Trolleys of Electric Railways, Tramways, and like purposes. A. Welsh. November 15th.

26,361. Adjustable Electrical Resistances. W. Engelke & H. Bloodworth. November 17th.

27,018. Selective Electric Signalling. New Phonopore Telephone Co., & A. H. Nicholson. November 24th. (Cognate application, 29,046/13.)

27,475. Systems and Apparatus for the Automatic Control of the Speed of Vehicles moving on Line Trackways. P. J. Simmen. November 28th.

1914.

1,238. Electric Current Regulators. P. Fincato. January 16th. (January 16th, 1913.)

1,691. Electric Lamps and their Fittings. H. E. Sheward. January 21st. (March 4th, 1914.)

1,786. Fluid Rheostats. Igranic Electric Co. (Cutler Hammer Manufacturing Co.) January 22nd.

2,924. System of Synchronising Electric Clocks. C. E. O'Keenan. February 4th. (February 5th, 1913. Patent of addition not granted.)

3,219. Illuminating Devices. E. C. McKinnie. February 6th. (May 19th, 1913.)

3,963. Apparatus for Generating High-frequency Oscillations for Wireless Telegraphy or Telephony. J. A. Fleming. February 16th.

4,010. Production of Electrotype Matrices. J. H. Mullaly. February 16th.

6,350. Arc Lamps. W. E. Gray & W. Best. March 12th.

10,061. Electric Furnaces. A. L. J. Queneau. April 23rd.

12,012. Starting Transformers. Akt. Ges. Brown, Boveri et Cie. May 15th. (June 2nd, 1913.)

13,784. Electric Insulators. P. Raffi. June 6th. (September 22nd, 1913.)

16,619. Selectors for Automatic Telephone Systems. G. A. Betulander & N. G. Palmgren. July 11th.

Ultra-Violet Rays.—In view of statements sometimes made by the enemies of the electric light, to the effect that it is harmful owing to the presence of ultra-violet rays, the following extracts from a paper by Messrs. W. R. Ham, Ph.D., R. B. Fehr, M.S., and R. E. Bitner, B.S., in the *Journal* of the Franklin Institute, are interesting:—"The primary object of this investigation was to develop a photographic method whereby the absorption of ultra-violet light by various absorbing media could be determined quantitatively. It is a well-known fact that ultra-violet light (light of wave length less than 390$\mu\mu$) may exert harmful physiological effects on the eye and skin, but just how much of this harm is to be ascribed to general energy radiation, and how much to specific radiation, is a matter that has by no means been settled. It is generally agreed that the extreme ultra-violet rays (those of wave length less than 300$\mu\mu$) cause injury when in sufficient intensity. There are some who claim that the rays between 360 and 300$\mu\mu$ also cause injury. Nutting states in Bureau of Standards Circular No. 28 that the 365th line of the mercury arc contributes 80 per cent. of the 'fatigue effect' when this arc is used as a source of light. Whatever may be the extent of the extremely harmful region, there seems to be as yet no clinical evidence to show that the ultra-violet rays which get through glass (glass in general may be said to completely absorb all rays of wave length less than 300$\mu\mu$ from any source) are injurious, unless in greater intensity than is to be found in any commercial light source."

After describing the apparatus and methods employed, and giving the results of the tests, the authors say:—"There does not seem to be any glass which transmits below the 302nd line, and which does not therefore cut out what are generally conceded to be the extremely harmful rays."